"IT'S A PRIVILEGE": A CRITICAL EXAMINATION OF UNIVERSITY STUDENTS' PERSPECTIVES OF ANIMAL EXPERIMENTATION PEDAGOGY IN CANADA

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Abstract

Animal experimentation is a controversial practice that persists in university education, despite the many available alternatives to effectively replace animal models. This thesis examines Brock University students' perspectives and educational experiences of animal experimentation, to understand how students make sense of this practice as a part of their education. This research consists of six in-depth interviews with Brock University undergraduate students who engaged in animal experimentation. The results show that students' experiences of animal experimentation pedagogy have greatly influenced their attitudes and perceptions of this practice, and have instilled in them an acceptance and perceived necessity of animal models. Most notably, students explicitly highlight their instructors as highly influential in shaping their acceptance and engagement in animal experimentation. The thesis concludes with an exploration of non-animal alternative methods to emphasize how principles of humane education can be used to foster more compassionate human-animal relations.

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Index

Chapter 1 – Introduction

Animal experimentation has been commonplace in education, with records dating back as far as the classical period in antiquity, before a revival in Western society in the sixteenth century (Rupke, 1990). It is a practice performed mostly in the natural sciences, with predominantly anthropocentric aims guiding research conducted on nonhuman animals (Monamy, 2009). Although this practice has been widely debated (e.g. Guerrini, 2003, Knight, 2011; Lankford, 2009; Rupke, 1990), we nonetheless know very little about students' experiences of learning animal experimentation, with some exceptions (e.g. Pedersen, 2002; Birke, Arluke and Michael, 2007; Deguchi, Molento and de Souza, 2012; De Villiers, 2012). Unfortunately, we know even less about Canadian contexts (e.g. Ellis, Hall, Ong, Wege, Paterson and Smith, 2010; Oakley, 2013).

In this thesis, I examine student perspectives and experiences of animal experimentation at Brock University. This examination is based on data collected through six in-depth interviews with Brock undergraduate students, who have experience engaging in animal experimentation for educational purposes. My driving research questions are, "How do students experience animal experimentation, its teaching, and its place in the curriculum?" and "How do these experiences potentially influence students' understandings of animal ethics?" Through these questions I explore students' perspectives of animal experimentation, while focusing on students' experiences of animal experimentation pedagogy to understand the construction of students' perspectives. Furthermore, by incorporating critical pedagogy, I critique how the knowledge and acceptance of animal experimentation is reproduced through (and, perhaps in some cases, resisted by) students. My hope is to help generate a deeper understanding of students'

experiences, to foster a richer dialogue about animal experimentation in university classrooms. In this introduction, I present a detailed analysis of the history of animal experimentation, to situate my topic in its historical context, followed by a summary of what will be discussed in each of my subsequent chapters.

Before proceeding, it is important to note that the term "animal experimentation" describes the biological, psychological, and medical scientific uses of live animals in research and educational settings (Monamy, 2009). I use the term animal experimentation rather than vivisection, because not all educational uses of animals result in the complete dissection and/or cutting of live animals (e.g. Fadali, 1996). Furthermore, while reviewing the literature, I found that the term animal experimentation was more commonly used in discussions within the scientific community. This could be due to experimenters wanting to use terminology that softens what they do, as the term vivisection, associated with the cutting of live animals, has negative connotations. Therefore, I wanted to keep my terminology of this practice consistent with language familiar to the students. Additionally, I use the term "animal" when referencing nonhuman animals, despite the fact that humans are also animals, for efficiency. The term "animal" is more commonly used within previous literature, and familiar with the terminology of my participants when discussing nonhuman animals.

History of Animal Experimentation

Animal experimentation has a long history of use dating back to antiquity (e.g. Monamy, 2009; Pedersen, 2002). From its earliest inception, the main purpose of animal experimentation was to satisfy anatomical curiosity (Monamy, 2009), and while the purposes of animal experimentation have expanded, this curiosity has been maintained over the past two thousand

years. In the subsequent historical analysis of animal experimentation, I will begin by examining the earliest uses of animal experiments in ancient times, followed by a discussion of the resurgence into this practice after the Middle Ages. Then I will conclude with an analysis of how these historical perspectives have influenced and shaped the current use of animal experimentation.

The earliest known records of animal experimentation date back to the third and fourth century BCE, most of which was happening in ancient Egypt, specifically in Alexandria (Maehle and Trohler, 1990). According to Pedersen (2002), Alexandria was once known as the center for science and education, and vivisection and dissection were performed on animals as well as humans, typically slaves and criminals. The fascination with live experiments largely came from wanting to see organs in natural conditions, without the post-mortem changes of an already deceased body (Maehle and Trohler, 1990). Moreover, physicians believed that while dissecting a deceased body could accurately depict structures of the body, the only way to examine the functions of said structures was through vivisection (Guerrini, 2003). Notable ancient physicians, such as Alcmaeon, Herophilos and Erasistratus, were among the first to utilize live experimentation, and to examine the functions of various nerves (e.g. Maehle and Trohler, 1990; Pedersen, 2002). Herophilos conducted experiments to differentiate tendons and nerves, Alcmaeon studied the optic nerve and blindness, and Erasistratos distinguished between motor and sensory nerves (Maehle and Trohler, 1990). Interestingly, there was opposition to live experiments in the beginning of this practice; however, the controversy was mainly centered around the use of live humans, debating whether or not this practice should be continued on slaves and criminals (Pedersen, 2002).

A few centuries later, the Greek physician Galen of Pergamon (c. 130-210 CE) used vivisection to understand brain, heart and spinal cord functions, as well as respiration (Maehle and Trohler, 1990). Galen, following Aristotle's views on animals, only granted animals limited consciousness, and showed very little concern for them, believing that they were less sensitive beings who felt less pain than humans (Guerrini, 2003). Therefore, Galen guided his students to engage in vivisection "without pity or compassion", and explained that the cries of pain from the animals were an unavoidable part of the experiment (Guerrini, 2003). According to Guerrini (2003), unlike his Alexandrian predecessors, Galen never performed or witnessed live experiments on humans. Furthermore, Galen's vast conduct of live animal experiments standardized the use of animal experimentation in the exploration of human systems and physiology, which pervades science to this day (Guerrini, 2003).

Moving into the Middle Ages, the practice of vivisection was seldom used in science, with very few scientists using this practice up until the Renaissance (Pedersen, 2002; Maehle and Trohler, 1990). Maehle and Trohler (1990) and Franco (2013) suggest that the declining use of vivisection during this time could be due to an upsurge in Christianity, as the predominant concerns seemed to be centered on eternal life, rather than earthly life. The resurgence of animal experimentation in the Renaissance occurred when anatomists and physicians rediscovered Galen's work with vivisection. Two notable physicians of the sixteenth century, Vesalius and his contemporary Colombo, justified the use of live animals as an indispensable tool for gaining physiological knowledge (Maehle and Trohler, 1990). While the use of humans in experiments was increasingly condemned, Vesalius did perform experiments on human cadavers, despite the opposition from the church, in which he compared the anatomy and structures of humans with various animals (Franco, 2013). Vesalius also found merit in vivisecting live animals for

learning, and used this practice as a resource in his teaching of medical students, which his student Colombo went on to continue (Franco, 2013).

Subsequently, during the seventeenth and eighteenth centuries, the use of animal experimentation continued to grow, largely on the presumed basis that animals do not actually feel pain (Pedersen, 2002). Rene Descartes provided scientists a way of justifying their egregious experiments by equating animals with machines, explaining that what distinguishes humans from other animals is the presence of a soul, and that without a soul animals were not able to feel *real* pain (e.g. Maehle and Trohler, 1990). While Descartes did recognize the existence of some feelings in animals, he believed that animals were simply going through the external motions of pain and that their capacity to feel pain was purely mechanical and lacked associated mental sensations of pain (Maehle and Trohler, 1990). Therefore, the cries of pain from animals being vivisected were reduced to a mechanical response, and thus differentiated from feelings of pain in soul bearing humans, to justify the cruelty inflicted on them. While Descartes did acknowledge the moral consequences of his theory on animals, he wrote, "my opinion is not so cruel to animals as it is favorable to men" (Maehle and Trohler, 1990). Thus, scientists were able to justify and normalize the practice of animal experimentation at this time through Descartes' mechanistic conceptualization of animals.

William Harvey (1578-1657), one of the most notable Western physiologists of the seventeenth century, controversially opposed much of Galen's theories, which were widely prevalent at the time (Franco, 2013). Harvey, who is now known as a founder of modern science, memorably used live animal experiments to describe and understand the function of the human heart and the process of blood circulation (Franco, 2013). Subsequently, as a result of Harvey's experiments, the value and rate of animal experimentation increased into the eighteenth and

nineteenth centuries, and moved beyond broad curiosity and into investigations of comparative physiology (Monamy, 2009).

According to Pedersen (2002), the eighteenth century experienced stagnation in animal experimentation, before a surge in the nineteenth century following the Industrial Revolution. With the traction gained from Harvey's experiments and the growth in resources from the Industrial Revolution, French physiologists Francois Magendie (1783-1855) and his student Claude Bernard (1813-1878) emerged. Magendie was notorious for his cruelty towards animals, even among fellow experimenters at the time, sparking contestation and public outcry over his work on the nervous system and absorption of poison (Pedersen, 2002). Conversely, Bernard received less criticism, due to the improvement of experimental techniques and introduction of anesthesia, which were perceived to reduce the amount of animal suffering (Pedersen, 2002). LaFollette and Shanks (1996), authors of *Brute Science*, highlight that while Bernard, the father of modern biomedicine, praised the use of animal experimentation and laboratory science, he disparaged the use of clinical medicine. Under Bernard's methodology, clinical observations, previous experiments and imagination become the basis for creating hypotheses, which are then tested on animals in laboratories, and the results of which are subsequently extended to human patients (LaFollette and Shanks, 1996). Therefore, two central tenets of Bernard's methodology are firstly that the laboratory is an essential setting in science, and secondly that animal experiments are directly related to human medicine (LaFollette and Shanks, 1996). As LaFollette and Shanks (1996) argue, it is clear that Bernard's principles have continued to permeate the scientific community over a century after his time. Furthermore, as a result of Magendie and Bernard's work, the development of experimental procedures and the invention of anesthesia, animal experimentation grew to become a routine part of laboratories throughout the West

(Monamy, 2009). Consequently, this led to the formal organization of the anti-vivisection movement, commencing in England (Pedersen, 2002).

Moving into the twentieth century, as animal experimentation became more routine, the advancements in medical knowledge, surgical techniques and treatments of disease were largely attributed to the use of animals. Franco (2013) explains that animal experimentation undoubtedly played a role in a number of medical discoveries, such as the discovery of antibiotics, insulin, vaccines, chemotherapy, blood transfusions, and advancements in diagnostic and surgical tools and technology. Consequently, these medical breakthroughs further instilled and emphasized the importance of animal experimentation (Monamy, 2009), among researchers and the public alike. Due to this permeating notion, that animal use was imperative for medical advancements, Franco (2013) notes a decline in antivivisection groups, and public support of them, until the 1970s. Other possible causes of this decline include the two World Wars and the great depression, which diminished perceived severity and importance of animal use in light of these other issues, as well as the fact that many experiments began using rats and mice as experimental models, which most people regarded as vermin (Franco, 2013). However, this opposition resurged in the later part of the twentieth century, particularly following Peter Singer's *Animal Liberation* and Tom Regan's *The Case for Animal Rights* (Franco, 2013). Their calls for the moral and ethical considerations of animals sparked a renewed interest in the opposition of animal experimentation, as well as other forms of animal exploitation in society.

Despite animal experimentation existing for over two thousand years, regulation of this practice is relatively new. In terms of legislation, the "Cruelty to Animals Act", enacted in Britain in 1876, was the first piece of legislation to ever regulate animal experimentation (Franco, 2013). While its intent was to address the alleviation of pain in laboratories through the

use anesthesia, it ultimately included a provision that allowed experiments to be conducted without anesthesia if granted permission from the president of a certified medical body (Lederer, 1990). Legislation started in the UK, and subsequent pieces followed in North America during the twentieth century.

Comparably, Canada enacted the first anti-cruelty laws in the Criminal Code in 1869 (Bisgould, 2011), however this was not specifically pertaining to animal experimentation. As animal rights lawyer Lesli Bisgould (2011) explains, while anti-cruelty laws prohibit willfully causing or permitting "unnecessary pain, suffering, or injury to an animal or bird" (section 445.1), this is rarely applied in industrial contexts due to provincial laws exempting forms of industrial and institutional animal use. Moreover, the current anti-cruelty laws in Canada first and foremost serve to protect animal owners against property damage (sections 444 and 445), as these laws are located under Part XI of the Criminal Code entitled, "Wilful and Forbidden Acts in Respect of Certain Property", while the actual harm inflicted upon the animal is secondary (sections 445.1, 446, 447 and 447.1) (Bisgould, 2011). Therefore, sentient animals are viewed legally as property, restricting their rights and protections, despite the fact that churches and corporations are viewed as legal persons under Canadian law (Gacek and Jochelson, 2017). Furthermore, there is no federal legislation that specifically covers animals used in research; rather the Canadian Council on Animal Care (CCAC) was created to oversee the practice of animal experimentation (Bisgould, 2011).

The CCAC was established in 1968 with the purpose of ensuring that animal use for research, testing and teaching provides animal care that is in accordance with scientific standards, and to promote knowledge and sensitivity to applicable ethical principles (Bisgould, 2011). On the surface this council may appear to assist and provide some protection to animals

used in experimentation; however, in actuality the CCAC is simply a channel that allows experimenters to avoid regulation of this practice (Sorenson, 2010). The CCAC is a group created by and for experimenters with vested interests in maintaining the use of animals in research (Sorenson, 2010). Additionally, the participation and compliance with the CCAC's guidelines are completely voluntary for private institutions; therefore many companies and institutions do not have to adhere to the CCAC, despite it being the only national system of oversight on animal experimentation (Sorenson, 2010; Bisgould, 2011). Furthermore, in a 2003 interview Dr. Clement Gauthier, the CCAC's executive director, admits that the CCAC has never stopped an experiment in all of its years of operation (Sorenson, 2010). Thus, as Sorenson (2010) explains, the CCAC acts as a smokescreen to protect the interests of institutions and researchers engaging in animal experimentation, while providing a front of legitimacy by concealing their activities and allowing them to operate without interference.

While no federal legislation exists specifically pertaining to the regulation of animal experimentation, Ontario does attempt to address this provincially under the *Animals for Research Act* (Bisgould, 2011). The *Animals for Research Act*, established in May of 1971, enacts that any facility that uses animals in research must be registered and that all supply facilities must be licensed (Bisgould, 2011). The main objectives of the act are to uphold a minimum standard of animal care and well-being in research, to protect animals in research from unnecessary pain, and to affirm that dogs are obtained legally for research (Urquhart and Kuzminski, 1993). While the act seemingly attempts to address animal welfare, it is riddled with ambiguity and provisions that undermine the protection of animals. For example, two of the provisions dealing with "unnecessary pain" [sections 16(1) and (2)] explain that an animal must be anesthetized if it is likely that the experiment will result in unnecessary pain, and that

analgesics must be used to prevent unnecessary pain during an animal's recovery (Bisgould, 2011). However, the term "unnecessary pain" is highly ambiguous, and no information is provided on exactly what constitutes necessary or unnecessary suffering (Sankoff, 2012). Furthermore, the abovementioned provisions do not apply to animals who are used in pain experiments, experiments in which monitoring pain is central, or if there is reason to believe that anesthesia or analgesics will tamper with results (Bisgould, 2011). Therefore, any attempt to protect animals under this act is insignificant, as human interests are clearly of more concern than the well-being of animals, based on the allowance of their continued use and the loopholes in their protections.

Furthermore, under section seventeen of the *Animals for Research Act*, it stipulates the requirement that an animal care committee be established at all registered research facilities (Bisgould, 2011). The animal care committee's purpose is to assure that the facility is in compliance with CCAC guidelines, to review research protocols and proposals and to ensure the consideration of alternatives (Bisgould, 2011). Ostensibly, these committees are meant to prevent unnecessary suffering (Urquhart and Kuzminski, 1993), however the extent to which they do is debatable. Similar to the composition of the CCAC, the animal care committees are overwhelmingly composed of people who are directly involved in animal experimentation and who share the belief that animal use is acceptable (Bisgould, 2011). While there is a position on the committee for an outside community member, who is not directly involved in animal experimentation, this position is not mandatory (Bisgould, 2011). Therefore, once again, the existence of this body appears to be more of a front to legitimize their actions and continue operating with little to no interference.

Despite the legislative effort of the *Animals for Research Act*, and the oversight of the CCAC and the animal care committees, it is clear that the interests of researchers and institutions are prioritized over the interests of the animals. Despite their purported aim of preventing "unnecessary pain", animal suffering has not ceased and continues to occur through the process of animal experimentation at the hand of the scientific community. Furthermore, as I have illustrated through the above historical analysis of animal experimentation, from antiquity to present day, the use of this practice in science research and education has evolved, but the overarching premise of using animals to satisfy our scientific and medical curiosities has remained intact.

Chapter Summaries

Noting the historical analysis of animal experimentation above, it is apparent that animal experimentation has been a controversial topic within the scientific community and the general public from its inception. While some processes of how animal experimentation is performed have changed over time, due to technological advancements, the inclination to use animals in scientific research and education has persisted and increased to the present day. In my thesis I examine students' experiences of animal experimentation and its teaching, and how students' experiences of pedagogy influence their understandings of this practice. In understanding students' experiences, and how pedagogy affects their perceptions of this practice, these findings will illuminate how the perceived necessity of animal experimentation is maintained and reproduced through pedagogy. In the subsequent chapters I discuss and examine the literature on my topic, the methodology and research methods that I employ to attain my qualitative data, my analysis of the data, and finally my suggestions regarding the available alternatives to animal

experimentation for education and how to move forward. Below I provide a summary of each chapter to outline what will be discussed throughout this thesis.

In Chapter Two, I offer a literature review to highlight the themes and past contributions of scholars writing on animal experimentation that have consequently informed my research. I begin by examining the debates on animal experimentation within the scientific community, to highlight the perspectives of those for and against the use of this practice in education and research more broadly. Then I shift my attention to specifically examine student perspectives and experiences of animal experimentation. I present themes on students' representations of animals, perspectives on dissection, different perceptions of men and women, and then examine the findings of past quantitative and qualitative studies on student experiences. Lastly, in this chapter I explore how literature has previously incorporated the theoretical framework of critical pedagogy into discussions on animal experimentation pedagogy. By reviewing these themes and connections, I highlight how my project further contributes to and builds upon previous work, as well how I situate my research within this field of study.

In Chapter Three, I elaborate on the methodological steps that I have taken throughout my research process. I expand on how a constructivist-interpretivist methodology has informed my project, and the benefits of this approach while examining students' perspectives and experiences of animal experimentation. Furthermore, this chapter provides an overview of the methods employed during the research design, sampling and interview process, and data analysis. To conclude this chapter, I highlight several key interview questions that I used to gain insight into students' perspectives and experiences of animal experimentation, and to address my initial research questions.

Subsequently, Chapter Four contains my interpretation and analysis of the interview data. I begin by outlining the theoretical frameworks, namely critical pedagogy and Critical Animal Studies (CAS), which I use to analyze my data. I then present a thematic analysis, based on the data from the six in-depth interviews with Brock students. The themes that I highlight include 1) acceptability, 2) misconceptions in the debate on animal experimentation, 3) gender differences, 4) ethical ambiguities, 5) absolution of culpability, 6) lives of luxury, 7) objectifying and obscuring language, and 8) marginalization of alternatives. These eight themes represent the major points of convergence between the six interviews, highlighting the perceptions and experiences of students engaging in animal experimentation in their education at Brock. Moreover, these themes allow me to understand how students experience animal experimentation and its teaching at Brock University and how these experiences of pedagogy influence students' understandings of this practice.

In the final chapter, Chapter Five, I focus on alternatives to animal experimentation for educational purposes, and how to move forward using a humane education framework. In this chapter, I outline various educational alternatives in detail, such as computer simulations and models, student self-experimentation, in vitro and clinical work. Furthermore, I highlight universities and programs that have implemented these alternatives in replacement of animal experimentation. It is within this chapter that I also encapsulate the discussions and arguments made throughout my thesis. Finally, I conclude with a discussion on the practical applications for my thesis and areas of future research, to further the conversation surrounding animal experimentation in Canadian universities.

Chapter 2: Literature Review

Animal experimentation literature draws on a variety of disciplines and perspectives to examine this scientific practice, including how it pertains to its uses in education. As noted in Chapter One, animal experimentation encompasses the biological, psychological, and medical scientific uses of live animals in research and educational settings (Monamy, 2009). Animal experimentation has not gone without opposition, from the anti-vivisection movements in Victorian England to the growing critique of research on animal experimentation from the natural and social sciences in recent decades (e.g. Bekoff, 2007; Fadali, 1996; Rupke, 1990). Past literature has highlighted the complexities within the growing debate on animal experimentation, within and beyond the scientific community. This debate is often very divisive, and I will therefore begin my analysis by outlining the debate within the scientific community, in order to understand the present controversy surrounding animal experimentation. I specifically focus on the debates within the scientific community, because these are the perspectives that students within the sciences would likely encounter, either through professors' own opinions or scientific journals. (I specifically focus on scientific journals because students did not mention any other journals as part of their course readings) Therefore, just as I have specifically chosen to examine perspectives of students within the scientific community, I am choosing to concentrate my analysis of the debate within the scientific community as well.

I will subsequently review literature that examines students' perceptions and experiences of animal experimentation, under the following emergent themes: representations of animals, dissection, men's and women's perspectives, quantitative studies on student experiences and qualitative studies on student experiences. Then I explore literature that has previously discussed

the theoretical framework of critical pedagogy in relation to animal experimentation pedagogy, as a preliminary point from which to build my research. Additionally, I will speak to the current gaps and situate my research project as a response. While I have separated the literature into themes, I would like to acknowledge that there are many links that make these themes often quite fluid and interconnected. The separate categorizations in this chapter are for organizational purposes, and are not intended to oversimplify the complexities of animal experimentation and the perspectives and experiences of students.

Animal Experimentation Debates within the Scientific Community

While some scholars believe scientists and researchers are unanimously in agreement on using animals in research, and that anyone against animal experimentation is a part of the animal rights community (e.g. Knight, Vrij, Bard & Brandon, 2009), numerous scientists and researchers speak out against animal experimentation (e.g. Anderegg, Cohen, Kaufman, Ruttenberg and Fano, 2002; Birke et al., 2007; Fadali, 1996; Greek and Greek, 2010; Lankford, 2009). The opposing viewpoints of scientists and researchers have created a divide within the literature, between those who are for and against the practice of animal experimentation. While the literature largely reflects strong opinions in favour or against animal experimentation, I acknowledge that not all perspectives within the scientific community fit dichotomously into being either for or against this practice. However, I have separated the literature in this way to highlight the main arguments made by those who support the practice of animal experimentation, versus those who do not. I subsequently outline the animal experimentation debate, in order to contextualize my research on students' perspectives within the general perspectives of the larger scientific community.

Scientists and Researchers in Favor of the use of Animal Experimentation

Many scientists and researchers continue to use and support animal experimentation. It is a common practice in the biological sciences and medical research communities, and while opposition exists, many assert that currently animal experimentation is necessary for various reasons and purposes (e.g. Conn and Parker, 2008; Folescu, Miftode and Zamfir, 2013; Lankford, 2009; Mogil, Davis and Derbyshire, 2010). Prominent arguments supporting animal experimentation include the following: Non-human animals' genetic makeup and DNA as closely related to humans, advances in scientific knowledge and the considerable past and present benefits to humans, and the lack of sufficient alternatives. Here I examine how these common arguments are used to justify animal experimentation within the scientific community.

Animal experimentation has been used in the natural sciences for over 2,000 years (Pedersen, 2002), and while it has changed over time, the practice of using animals for the advancement of scientific knowledge and education has remained intact. In fact, some believe that most scientific knowledge has been attained through animal experimentation (e.g. Conn & Parker, 2008; Foundation for Biomedical Research, 2009; Poste, 2009). Therefore this justification is largely centered on the benefits of animal experimentation to humans, either through the drugs and vaccines that have been tested on animals, or through the acquisition of general scientific knowledge. As Derbyshire (2009) asserts, it is a moral choice of researchers and scientists to put human interests above and before animals. In the literature coming from the scientific community in support of animal experimentation, this is a common theme, whereby humans are seen as superior, and thus their interests are prioritized over animal lives. This assumed benefit of animal experimentation on humans is also used to equate animal experimentation with saving human lives (e.g. Lankford, 2009; Poste, 2009). Some argue that

without animal experimentation, drugs and vaccines, medical procedures, and life saving surgeries would not exist (e.g. Foundation for Biomedical Research, 2009; Poste, 2009).

Subsequently, as animals have been considered pivotal in the advancement of scientific knowledge and human health, their genetic similarities have been used to justify their continued use. Many scientists and researchers claim that the biological similarities between animals and humans make animal models ideal for extrapolating data to humans, and providing the scientific community with important insight into related human systems (Foundation for Biomedical Research, 2009). Similarly, the American Physiological Society (APS), made up of mostly physiologists or other medical/health professionals, claims that animals are used in research because of their biological similarities to humans and their susceptibility to similar health problems (APS, 2001). As Carbone (2012) argues, in order to justify animal experimentation a balance needs to be achieved, in which animals are biologically similar enough to humans for extrapolation across species to be useful, while sufficiently different enough to morally warrant their use and differential treatment compared to humans. Similarly Conn and Parker (2008), assert that due to the similarities between animals and humans, animals have been pivotal in medical discoveries such as penicillin, the polio vaccine and research on diabetes. However, they later argue that in the case of great apes, who share 98.5% DNA with humans, the 1.5% difference equates to 45 million genetic differences, which they claim is significant enough to deny great apes legal rights and protections against being used in research (Conn and Parker, 2008). Therefore, while the similarities between animals and humans are often used as a justification for their continued use in extrapolating transferable data, there must also be enough evidence that animals are different enough from humans to be used in experiments in the first place, which can often be contradictory. Thus, Monamy (2009) raises the question, “if these

animals are so like us, why do we treat them so differently?" (p. 37), drawing attention to this contradiction.

While many scientists and researchers openly acknowledge the shortcomings and limitations of animal research (e.g. McGonigle and Ruggeri, 2014; Mogil et al., 2010), they continue to assert that it is the best option available, and that rather than removing animal models we need to focus on improving them. While alternatives to animal experimentation exist, such as computer simulations and models, noninvasive imaging techniques, statistical modeling, cell cultures, epidemiology and human volunteers (Folescu et al., 2013), there is extensive debate within the scientific community regarding the legitimacy and reliability of these alternatives in comparison to animal models. Those in support of animal experimentation often argue that there is a lack of sufficient and transferable alternatives that can fully replace the use of animals in research (e.g. Conn & Parker, 2008; Knight et al., 2009; PIR Partners Research, 2009; Poste, 2009). However, while some outright oppose alternatives (e.g. Lankford, 2009), others see merit in alternative methods when used in conjunction with animal models (e.g. Carbone, 2012; McGonigle and Ruggeri, 2014). Carbone (2012) argues that in order to build a comprehensive body of knowledge, animal models, cell cultures, computer simulations and human studies need to be used together. Similarly, McGonigle and Ruggeri (2014) assert that animal models should be one of many tools employed in a portfolio, in order to minimize the false representation of animal models as absolute predictors for human conditions and responses.

In addition to their opposition to non-animal based models, researchers in support of animal experimentation continuously assert that by adhering to the 'three Rs' principle they are engaging in animal welfare and ethics. The three Rs, as outlined by Kopp (2012), represents the "*replacement* of animals with non-animal research models, *reduction* of total animals needed by

a given study, or *refinement* of current procedures to minimize distress and improve well-being" (p. 19). While the 3Rs might seem like a progressive step forward, some opponents of the 'three Rs', argue that this principle is dishonest and part of a welfarist platform that hardly operates in the interest of animals (Greek and Greek, 2010). Greek and Greek (2010) highlight the contradiction of the 'three Rs' principle, as researchers are promoting themselves as advocates of animal welfare, while also continuing to use them in harmful experiments. Thus, in actuality, welfarist discourse is used as an ethical guise, all while maintaining the status quo of using animals in egregious ways in science (Almiron and Khazaal, 2016). Furthermore, Juke and Martinsen (2008) assert that only one 'R' is needed, replacement; as past research confirms that not only is this possible, but it would also help to foster humanity in science education by removing harmful animal experiments and replacing them with helpful and humane alternatives. Debate regarding the 'three Rs' principle exemplifies the complexities within the larger animal experimentation debate, in which fervent disagreements are ubiquitous.

Scientists and Researchers Against the use of Animal Experimentation

In contrast to proponents of animal experimentation, many scientists and researchers are opposed to the use of animals in science and research. As mentioned above, their positions and arguments are often in stark contrast with the pro-experimentation positions. Some of the themes that I highlight below, emergent from the literature against animal experimentation within the scientific community, include the moral implications of animal use, the unreliability and high failure rate of animal research, and the availability of successful alternatives.

A prominent pro-experimentation argument centers on the benefits of animal use for obtaining scientific knowledge, and how experimentation improves human health (e.g. Conn &

Parker, 2008; Derbyshire, 2009; Poste, 2009). However, some researchers question whether the human benefits associated with animal experimentation are enough to excuse the moral implications of using animals in research (e.g. Almiron & Khazaal, 2016; Knight et al., 2009; Monamy, 2009; Regan, 2004; Rollin, 2012). While animal rights ethicist Regan (2004), notes that human health improvements can be connected to animal experimentation, he asserts that this does not automatically make the use of animals morally justified. Monamy (2009) explains how complicated the issues of ethics and morality are within the debates on animal experimentation, as we have yet to reach any consensus on the moral parameters of this practice. Some members of the scientific community believe that only humans are worth moral consideration, while others believe that all animals deserve the same, and many positions on moral justification fall in between, involving consideration for only certain animal species (Monamy, 2009).

Those who oppose animal experimentation often assert that the use of animals in experimentation is morally unjustifiable (e.g. Knight et al., 2009; Monamy, 2009; Regan, 2004; Rollin, 2012). What constitutes moral consideration for animals can vary, even among those who oppose animal use. Arguments against the use of animal experimentation, based on morality, often include considerations of their ability to feel and suffer, their inherent value as living-beings, and/or animals' interest in life (e.g. Knight, 2011; Monamy, 2009; Pedersen, 2004; Rollin, 2012). As Regan (2004) asserts, no single argument can be used to settle everything in the animal experimentation debate, rather multiple relevant arguments should be considered in order to advance the moral status of animals. In response to these critiques, those in favour of animal experimentation may argue that the human benefits outweigh the moral costs of using animals, and that it is a justifiable choice to put human benefits first (Derbyshire, 2009). However, as Regan (2004) posits, there is no clear-cut way of determining how to weigh the

costs and benefits, especially across species. Additionally, in the myriad of ways that animals are subjected to painful experiments, many appear to be without much practical value, which further refutes the assumption that the human benefits outweigh the costs to the research animals (Rollin, 2012). Although the moral arguments against animal experimentation are sometimes thought to be solely coming from the animal rights community, it is clear that more and more researchers and scientists within the scientific community are opposing this practice (e.g. Greek and Greek, 2010; Jukes and Chiuia, 2006; Fadali, 1996; Anderegg et al., 2002; Folescu et al., 2013), in part due to the moral issues surrounding animal experimentation.

While those in favour of animal experimentation boast about the medical breakthroughs that necessitate animal research, the proportion of animal experimentation related to medical breakthroughs is unclear. According to the CCAC (2017), based on the animals and experiments reported in 2016, 57.3% of animal experimentation was used in fundamental research, 14.1% was used to develop products or devices (e.g. appliances for human and veterinary medicine), 12.8% was used in clinical/medical studies, 9.7% was used for education and training, and 6.1% was used for regulatory testing (e.g. toxicity testing and cosmetic testing). Therefore, the majority of animal experimentation in Canada (57.3%) seems to be related to 'fundamental research', which accordingly to Greek and Greek (2010) is synonymous with basic research or curiosity-driven research, whereby experimental work is conducted for the acquirement of new knowledge without any specific use or application in mind. Thus, the majority of animal experiments are not necessarily contributing to medical breakthroughs, and when they seemingly do, it is often not clear if such achievements were dependent on animal models, or if these models were merely included at some point of the research process (Matthews, 2008).

Furthermore, animal experimentation becomes highly controversial as researchers continue to oppose and critique this practice due to the high failure rates and unreliability of animal models. As Folescu et al. (2013) posit, there have been many misleading conclusions drawn from animal experimentation, and therefore extrapolation to humans is not often successful, particularly in regards to toxicity data. A common example many authors and scientists draw on to illustrate this point is thalidomide (e.g. Fadali, 1996; Folescu et al., 2013; Monamy, 2009), which was given to pregnant women to combat morning sickness but ultimately led to birth defects, even though the drug was declared safe after being tested on pregnant rodents (Monamy, 2009). While this is just one example commonly used, Fadali (1996) provides an extensive, but by no means exhaustive, list of other drugs that passed in the stages of animal testing but failed in human tests, such as oraflex, chloramphenicol, urethane and amydopyrine to name a few. Furthermore, Anderegg et al. (2002) note how animal data has historically misled researchers on the correlation between smoking and lung cancer, asbestos and cancer, and various lethal dose toxicity tests. In these cases, researchers were lead to believe that there was no connection between smoking and lung cancer, and asbestos and cancer, based on data from animal experiments (Anderegg et al., 2002), despite the fact that both are now known to be cancer causing agents. Additionally, industries are able to spin the data from animal experiments in various ways to support their endeavors. Therefore, while proponents of animal experimentation are quick to call attention to the cases of animal use that were transferable to humans, they often ignore the majority that indicates otherwise (Greek and Greek, 2002). Based on this point of contention within the scientific community, Greek and Greek (2002) assert that it is scientifically unsound that animal experimentation continues, since the results are only occasionally applicable to humans.

Considering the unreliability of animal experiments to translate to human conditions, Greek and Greek (2010) also contend that even among the most promising animal research data, most of it will never reach clinical trial stages. Most researchers against animal experimentation attribute these high failure rates to be due to interspecies differences (e.g. Anderegg et al., 2002; Birke, 2012; Greek and Greek, 2010; Knight, 2011). Among the research that does advance to clinical studies, Knight (2011) argues that interspecies differences in the metabolic pathways are a leading cause of high failure rates, particularly in drug development, as only 8% of drugs tested on humans, after being found safe in animal models, gain FDA approval. It is precisely when these interspecies differences are ignored, and when instances of human disease are artificially produced in other species, that high failure rates ensue (Anderegg et al., 2002).

While Birke (2012) also discusses species differences in physiology, leading animal models to transfer poorly to humans, a second key factor that she discusses is the predominant use of male animals, which is inadequate for diseases that are different or more prevalent in females. Additionally, Anderegg et al. (2002), Birke (2012) and Knight (2011) argue that unnatural lab environments can also greatly impact research results. It becomes very difficult to standardize all aspects of an experiment using animals, particularly the intricacies of how animals are housed and handled by technicians, which are not often documented in writing (Birke, 2012). Subsequently, the varying environmental conditions where animals are kept, as well as the handling techniques, significantly impact their stress levels, thus influence their hormone chemistry and the results of the data (Knight, 2011). Therefore, generalizability and extrapolation are easily compromised in the experimental process of animal models.

As a result of this lack of confidence in animal research to provide scientists with transferable data to human conditions and reactions, many alternatives have been developed.

While proponents of animal experimentation firmly assert that alternatives cannot replace animal models, those against the use of animal experimentation conversely argue that alternatives are not only readily available, but also more successful (e.g. Anderegg et al., 2002; Greek and Greek, 2010; Folescu et al., 2013). Additionally, Greek and Greek (2010) and Birke (2012) argue that while animal experimentation has contributed to scientific and medical knowledge, we cannot know if the same achievements or more could have been achieved without the use of animals. Anderegg et al. (2002) contend that alternative methods have a higher validity and accuracy in predicting human reaction and response, and they are also less expensive than animal models. Some prominent alternatives supported by those opposed to experimentation include noninvasive imaging techniques, in vitro, computer models and simulations, human stem cells research, large scale epidemiology and autopsies (Anderegg et al., 2002; Folescu et al., 2013; Greek and Greek, 2010). (A more detailed analysis of said alternatives, in relation to education, will be discussed in Chapter Five of my thesis.) Furthermore, Folescu et al. (2013) assert that human pathological mechanisms can be better understood using these alternatives than animal experimentation.

With so many alternatives supported by members of the scientific community, many opponents of animal research have questioned why the use of animals continues to exist in science and research (e.g. Almiron and Khazaal, 2016; Anderegg et al., 2002; Greek and Greek, 2010). Various key factors, as highlighted in the literature, continue to influence the persistence of animal experimentation, such as faster publication rates, financial and professional gains in the status quo, and vested capitalist interests (e.g. Almiron and Khazaal, 2016; Anderegg et al., 2002; Greek and Greek, 2010). Greek and Greek (2010) quote immunologist Dr. Ralph Steinman who said, “Most of our best people work in lab animals, not people” (p. 9), to exemplify how

extensive resources and talent are spent on animal research, and how removed many scientists are from addressing actual human diseases. Anderegg et al. (2002) explain that one of the reasons that talent and resources are focused on animal research, rather than clinical research, is because it is less time consuming and therefore easier to produce quick publications. This is particularly significant in academia, in which a "publish or perish" mentality is looming over researchers (Anderegg et al., 2002).

Furthermore, many scientists' educational backgrounds, salaries and professional reputations are based in animal research, which prompts an inclination to maintain the status quo within the research community (Anderegg et al., 2002). In addition to the financial and professional gains of individual members in the scientific community, animal experimentation is also a very lucrative business venture (e.g. Anderegg et al., 2002; Greek and Greek, 2010; Almiron and Khazaal, 2016). As Almiron and Khazaal (2016) assert, the Vivisection Industrial Complex, made up of businesses and institutions that directly or indirectly support, conduct and/or benefit from animal experimentation, lobby to maintain the use of animals in research. The Vivisection Industrial Complex is made up of public or private corporations that conduct animal experimentation (e.g. pharmaceutical or cosmetic companies), academic institutions, and companies that supply the animals (Almiron and Khazaal, 2016). The companies and institutions that continue to support animal experimentation, while actively opposing public dissent and alternative methods, have vested financial interests in maintaining the continued use of animals in research. Subsequently, scientists and researchers rarely question animal experimentation, choosing to vehemently defend this practice rather than challenging the moral issues associated with it (Anderegg et al., 2002). Moreover, Anderegg et al. (2002), citing sociologist Arnold Arluke (1994), assert that young researchers are quick to learn and adopt this mindset on animal

experimentation from their superiors, thus leading to the persistence and reproduction of this practice.

Student Experiences of Animal Experimentation

While much attention has been spent on examining the debates on the practice of animal experimentation, current literature largely fails to focus on the perspectives of students engaged in animal experimentation; however, there are some notable contributions. Student perspectives are important in the conversation of animal experimentation in education, as they are the beneficiaries of this pedagogy. Therefore, students have a unique stance in this practice and their voices should be centralized in the discussion, in order to understand their experiences and the production of this knowledge. Much of the literature that I have outlined above could benefit from students' views, especially in the literature about animal experimentation for educational purposes. Current discussions on students' experiences engaging in animal experimentation for educational purposes largely focus on representations of animals, comparative analyses of experiences learning with animal models versus alternative methods, dissection, differential perspectives of men and women, and quantitative studies. Here I discuss Pedersen (2010), Birke et al. (2007), Ozen and Ozen (2010), and a few other noteworthy contributors to the study of student experiences of animal experimentation, whose scholarship I build on in my own work.

Representations of Animals

As Birke et al. (2007) and Peggs (2015) argue, the use of animals in experimentation, in laboratories and classroom settings, engenders a normalization of animals as a regular part of the lab apparatus, similar to the other tools and objects used in the lab. This use of animals in

laboratories and classroom settings mirrors the anthropocentric and speciesist attitudes that pervade society, through the general assumption that we are free to use animals as we wish. Representations of animals shift from 'naturalistic animals' to analytic objects in research and learning facilities (Lynch, 1988), creating an environment in which animals are a means to a researcher's end (Birke et al., 2007). As Arluke (1988) argues, this objectification is required so that animals can be treated in ways that otherwise would be difficult for the researchers. The process of objectification is achieved through the commodification of subjective beings, the assignment of numerical identities rather than names, and the social and cultural norms and meanings that are taught in lab settings (e,g, Arluke, 1988; Pedersen, 2010). As Pedersen (2010) explains, the cultural meanings of lab animals are not as selves, but as bodies. This is a very common representation of animals in experimentation according to multiple other authors, who comment on the accessibility of animal bodies for manipulation, and the conceptualization of lab animals as bodies for human use (e.g. Arluke, 1988; Lynch, 1988; Pedersen, 2010, Peggs, 2015).

Dissection

Many studies have also examined students' attitudes to the use of dissection in their curriculum (e.g. Bowd, 1993; DeHoff, Clark and Meganathan, 2011; Fancovicova, Prokop and Leskova, 2013; Oakley, 2013; Osenkowski, Green, Tjaden & Cunniff, 2015; Waters, Van Meter, Perrotti, Drogo & Cyr, 2011). In Ontario, dissection is part of the grade ten science and grades eleven and twelve biology curriculum; while teachers have the option of using dissection, computer simulations, or both (Oakley, 2013), students do not always have a choice in the matter. While dissection is a prevalent part of high school curriculum, it also occurs alongside animal experimentation in college and university settings (e.g. DeHoff et al., 2011; Waters et al.,

2011). In the case of high school students, Osenkowski et al. (2015) found that from their nationwide sample of five hundred students across the United States, forty-eight percent would prefer animal dissection, thirty-seven percent of students preferred to use an alternative, and fifteen percent did not know. However sixty-eight percent of students felt that there should be a choice to opt out of dissection (Osenkowski et al., 2015).

While multiple studies support the idea of student choice policies in high school dissection (e.g. Bowd, 1993; Cunningham, 2003; Oakley, 2013; Osenkowski et al., 2015), Oakley (2013) found that only thirty-three percent of students that oppose dissection are provided alternatives in Ontario, from a sample of three hundred and eleven former high school students. The other two-thirds of the students that oppose dissection are convinced to do it by their teachers, made to watch another student perform the dissection, failed on that portion of the assignment, or forced to find their own alternatives (Oakley, 2013). This is problematic because when students have negative attitudes towards dissection, and are not given a non-animal alternative, it can negatively impact their learning outcomes due to their discomfort (Francovicova et al., 2013).

In terms of dissection in university settings, Waters et al. (2011) and DeHoff et al. (2011) conducted quantitative studies on student perceptions of cat dissection versus the non-animal alternative of clay models, with promising results for legitimizing alternative models. DeHoff et al. (2011) found that while both methods accomplished the learning objectives, the majority of students felt that clay modeling was more enjoyable than dissection. Waters et al. (2011) found that when comparing dissection to non-animal alternatives, students preferred the method that they were predominantly taught. Once again this indicates that at least some students are more

likely to prefer the methods taught to them by their teachers, suggesting the potential impact that pedagogy has on student perceptions and experiences of using animal models in education.

High school dissection is an important place to begin considering how students feel about the use of animals in science and teaching, because it represents their first encounters with animals as scientific research objects. I speculate that the experiences that students have in high-school dissection will ultimately bear on what programs they go on to take in college or university. Moreover, negative feelings towards dissection could inhibit students from pursing further education in the sciences, as the general consensus among students in my sample was that they expected animal experimentation would be a part of their undergraduate education going into it. I build on this previous research by incorporating questions in my interviews regarding previous experiences of dissection in high school and the transition to live animals in university experimentation.

Different Perceptions of Men and Women

Multiple studies also suggest that men's and women's views on dissection and animal experimentation differ, with women tending to be more sympathetic and opposed to the use of animals than men (i.e., Birke et al., 2007; De Villiers, 2012; Fancovicova et al., 2013; Oakley, 2013; Ozen and Ozen, 2010; Pedersen, 2002). De Villiers (2012) found that eighty-three percent of women felt negatively about animal experimentation compared to fifty percent of men, out of one hundred students surveyed. When comparing the use of animal experimentation versus non-animal alternatives, Fancovicova et al. (2013) found that men favoured dissection more than women. Similarly Oakley (2013) found that this is also true in regards to high school dissections, with women objecting to classroom dissections more often than men. Pedersen (2002) argues

that this discrepancy is likely due to gender stereotypical behaviour; many of the girls in dissection classrooms think it is “gross”, while the boys are more excited and eager to “dig in”. As Birke et al. (2007) assert, this could be an indication of the male students’ need to display masculinity through dissection and animal experimentation. Furthermore, the domination over other animals is inextricably linked with masculinity, since the capacity to dominate has historically been seen as a male trait (Luke, 2007). The link between masculinity and animal experimentation will be further discussed in Chapter Four, under the subheading “Gender Differences”.

Quantitative Studies on Student Experiences

Furthermore, when research does take into account the experiences of students, the majority uses quantitative methods (i.e., De Villiers, 2012; Osenkowski et al., 2015; Ozen and Ozen, 2010; Pedersen, 2002). These quantitative studies use questionnaires to survey students on their perspectives of animal experimentation, some using a mixed methodology of closed and open-ended questions (i.e., De Villiers, 2012; Deguchi et al., 2012; Ellis et al., 2010). As Ozen and Ozen (2010) and De Villiers (2012) demonstrate in their surveys, the majority of students responded negatively to the use of animals, when asked about animal experimentation. Ozen and Ozen (2010) found that three-fifths of students out of the seven hundred and thirty-nine that were sampled, in the faculties of Veterinary Medicine, Biology, Civil Engineering and Fine Arts at Erciyes University in Turkey, had negative attitudes to the general practice of animal experimentation. Comparably, from a sample of one hundred prospective science teachers in a Bachelor of Education program at a South African University, De Villiers (2012) found that eighty-three percent of women and fifty percent of men responded negatively to animal

experimentation in education. However, regardless of these negative attitudes, the majority of students still felt that animal experimentation was necessary and were in favour of it (e.g. Deguchi et al., 2012; Knight and Barnett, 2008; Ozen and Ozen, 2010).

As Ozen and Ozen (2010) argue, students found animal experimentation to be necessary because of the ease, cost efficiency, and believed reliability of animal models over alternative methods. However, generally alternative methods tend to be easier and less costly, and there is no consensus on reliability of animal experimentation over alternatives; therefore, Ozen and Ozen (2010) posit that the student responses likely indicate that they are misinformed on alternatives. Alternative methods to the use of live animals in experimentation include pictures and videos, computer models, simulations, cell cultures, and mannequins (Deguchi et al., 2012). It is important to note that Ozen and Ozen (2010) are referring to animal experimentation generally as a research practice, rather than specifically for educational purposes.

Many of the quantitative studies included a comparative analysis of students' views on alternative methods to animal experimentation (e.g. Deguchi et al., 2012; Ellis et al., 2010; Ozen and Ozen, 2010; Pedersen, 2002). Deguchi et al. (2012) found that students liked alternative methods *in addition* to animal experimentation, but not as a replacement of animal models. After analyzing the replies to open-ended survey questions, Deguchi et al. (2012) argue that this opinion is likely due to professors being more careless and unprepared in their teaching approach when using alternatives. Deguchi et al., (2012) provide a quote from one student explaining that "sometimes lecturers are not prepared to use these resources, so the results are not satisfactory" (p. 87), while discussing alternative methods.

In contrast, some studies found that alternatives were as good if not better than animal experimentation, in teaching the learning objectives, and preferred by students (e.g. Pedersen,

2002; Wang, 2001). Out of twenty-nine quantitative studies that addressed student performance using animal models versus alternative models, sixteen showed equal performance between alternatives and animal models, twelve showed better performance using alternative models, and only one showed better student performance with animal models (Pedersen, 2002). As noted in Wang (2001), a survey of seventy-five fourth year students in pharmacology found that after conducting one experiment on live animals and seven computer simulations, all of the respondents preferred the alternative computer simulation to using live animals in experiments. Therefore, Wang (2001) in Australia and Deguchi et al. (2012) in Brazil, help confirm Pedersen's argument that students' views on animal experimentation are dependent on the methods predominantly taught to them (2002).

From a Canadian perspective, Ellis et al. (2010) examined animal experimentation at Dalhousie University and the perceptions of psychology students using quantitative surveys. Fifty-four percent of psychology students reported having been exposed to animals, while sixty-four percent were exposed to alternative methods, in a sample of forty-six students (Ellis et al., 2010). The findings revealed that students viewed animal experimentation as necessary for "humanity's progress" when it comes to research; however, for teaching purposes they felt that alternative methods are successful replacements (Ellis et al., 2010). With the exception of this study, the overwhelming majority of research on student experiences engaging in animal experimentation occurs in Europe and the United States. Thus, my research addresses this gap, as I examine student experiences of animal experimentation in a Canadian University. While Ellis et al. (2010) have certainly confronted this gap in the form of a quantitative survey; my research provides a more detailed qualitative account of the students' experiences.

The benefit of these quantitative studies is that they were able to include sample sizes upwards of seven hundred participants; however, many lacked a deeper analysis of why students had certain attitudes of animal experimentation and how their learning influenced their perspectives, which I examine. Some of these studies also included students from various disciplines that did not engage in animal experimentation, to examine the student body as a whole regardless of whether they engaged in this practice (e.g. De Villiers, 2012; Ozen and Ozen, 2010). Furthermore, not all of them specifically examined animal experimentation for educational purposes; rather they looked at animal experimentation for research more generally (e.g. Knight and Barnett, 2008; Ozen and Ozen, 2010). Therefore, my project builds on this previous research by incorporating qualitative research that draws on critical pedagogy (e.g. Freire, 2000; Giroux, 2011), which questions the "hidden curriculum" (e.g. Giroux, 1983; Taylor and Robinson, 2009) involved in standard pedagogy, to understand the perspectives of students involved in animal experimentation as part of their education and how they make sense of these practices.

Qualitative Studies on Student Experiences

While there is significantly less qualitative research on student experiences of animal experimentation, there are noteworthy contributions that I draw upon in my research (e.g. Birke et al., 2007; Pedersen, 2010; Oakley, 2013). For example, Birke et al. (2007) includes students' voices from qualitative interviews with students in medical school to examine the socialization and rationalization processes students experience when engaged in animal experimentation. They found that most students assumed that the live animals were "as good as dead" once entering the lab (Birke et al., 2007), meaning that as lab animals, their fate was already determined and even

if they did not use them, someone else would. Furthermore, Birke et al. (2007) also found that students often displaced the blame for the animals' deaths onto the animal technicians. I expand on this work by examining how the socialization process is produced through pedagogy.

In the qualitative research by Pedersen (2010), the student perspectives that she highlights are from students in animal caretaker programs in vocational schools, where students are trained as caretakers for a range of animals in animal facilities such as labs, zoos, farms, or sanctuaries. Although in this work Pedersen (2010) does not discuss animal experimentation as a part of the students' education, she examines how students' identities as future animal caretakers are shaped by their education (Pedersen, 2010). Pedersen (2010) illustrates that through their experience of pedagogy, students undergo a desocialization process, in which their affectionate responses to animals in the beginning of the program are tapered towards a more "professional" and "scientific rationale" for the care that they provide. I expand on this concept of desocialization and consider it in relation to university students engaged in animal experimentation, to see if they experience a similar transition in how they are taught to view animals in education.

Pedagogy and Animal Experimentation

While critical pedagogy theory provides significant contributions to the discussions of student voice and pedagogy, it does not typically acknowledge animals within its framework. Accordingly, Corman (2011) critiques the speciesism and anthropocentrism within Friere's ground breaking critical pedagogy text, *Pedagogy of the Oppressed*, emphasizing and problematizing the exclusion of animal subjectivity and the degrading construction of animals as existing only in relation to humans. Consequently, for nonhuman animals, Friere's text

reproduces oppressive hierarchical power structures that it otherwise aims to eliminate (Corman, 2011). However, there are some scholars who have made the connection between critical pedagogy and animal exploitation, most notably Helena Pedersen whose work I build on. A core principle of critical pedagogy is on the inclusion of oppressed groups, and making education operate against injustice and oppression (Pedersen, 2004); therefore, Pedersen justifies her extension of critical pedagogy to include animals as an oppressed group in education.

The scholarship that addresses pedagogy and animal exploitation centralizes pedagogy, and the educational apparatus, as one key site of socialization, in which students' values are shaped regarding human-animal relations (e.g. Deguchi et al., 2012; Pedersen, 2010; Pedersen, 2004; Pedersen, 2002). These discussions connect pedagogy to animal exploitation more generally (e.g. animal objectification, consumption of animals, animals for entertainment), as well as specifically in relation to the practice of animal experimentation in educational settings (e.g. Capaldo, 2004; Deguchi et al., 2012; Pedersen, 2002). As multiple past studies have shown, the socialization process of animal experimentation, through pedagogy, influences students' perceptions and experiences of nonhuman animals in science (e.g. Deguchi et al., 2012; Pedersen, 2002; Jukes and Martinsen, 2008).

Previous literature has shown that students can be influenced in direct and indirect ways though pedagogy and the hidden curriculum. In the case of animal experimentation, direct pedagogy could involve the teaching of specific skills, procedures, and anatomy. Whereas the hidden curriculum of animal experimentation pedagogy acts in latent ways, to teach the acceptability of harmful experiments and the essentiality of animal use (Jukes and Martinsen, 2008). Zeidler, Walker, Ackett and Simmons (2002) contend that views on this practice can be influenced based on what and how material is presented to students. Therefore the school

becomes a crucial cite in the reproduction and maintenance of using animals in research and education. As Greek and Greek (2010) note, students are misled through pedagogy to equate animal experimentation with life saving cures for human illnesses, even though animal experimentation does not typically lead to significant medical advancements, as previously discussed. Similarly Birke (2012) posits that when students are taught that animal experimentation has been and continues to be our only salvation from suffering, they justify these harmful practices in order to achieve this. Therefore, when students are taught that animal experimentation is an essential part of science and medicine it becomes easier to accept and support the use of animals in education and research, which is part of the hidden curriculum of animal experimentation pedagogy. As Pedersen (2004) explains, a speciesist hidden curriculum, rooted in anthropocentric bias, is embedded in education. Greek and Greek (2010) and Birke (2012) illustrate this, as students are able to justify animal experimentation when they are taught that it is for the good of human medical advancements.

Furthermore, the hidden curriculum in animal experimentation pedagogy also promotes students' desensitization towards animals (e.g. Birke et al., 2007; Capaldo, 2004; Jukes and Martinsen, 2008; Pedersen, 2002). Jukes and Martinsen (2008) argue that by adhering to the hidden curriculum and accepting the harmful use of animals in experimentation, students are desensitized to animal suffering. Subsequently, this undermines the fundamental concept of caring in medical professions (Jukes and Martinsen, 2008). Similarly Pedersen (2002) examines the concerns of desensitization, as students may lose the ability to feel empathy and compassion for others by engaging in animal experimentation. In accordance with Jukes and Martinsen (2008) and Pedersen (2004), Birke et al. (2007) consider this desensitization with the concept of emotional ambivalence, whereby students, scientists and technicians must learn to view animals

as just another object in the lab, rather than as sentient beings, in order to professionally use them. In addition, Capaldo (2004) asserts that the hidden curriculum of emotion neutrality equates concealing emotions with competency and professionalism in the scientific community. Therefore, students who are uncomfortable with animal experimentation may feel compelled to do it anyway, in accordance with this principle (Capaldo, 2004). Previous research has also found that students in their later years of study showed less empathy towards animals, and rated animals as being less sentient, than younger students (Capaldo, 2004), highlighting the progression of desensitization through the hidden curriculum over the course of one's education. In all of these cases, it is through a hidden curriculum that students come to learn to desensitize and distance their emotions from the animals being used, in order to perform animal experiments.

Using past studies of students' perspectives on animal experimentation and the emerging literature on the interconnection of pedagogy and animal experimentation, I extend and complicate the findings of several foundational pieces (e.g. Birke et al., 2007; Capaldo, 2004; Deguchi et al., 2012; Pedersen, 2002; Pedersen, 2004; Pedersen, 2010). In addition to addressing the gap of qualitative research on student experiences and perceptions of animal experimentation in a Canadian context, I will centralize the influence of pedagogy on students, allowing me to critically examine how students' perceptions are shaped.

I am interested in exploring students' experiences of animal experimentation pedagogy, and understanding how pedagogy affects their perceptions of this practice and animals in general. As Pedersen (2010) argues, discussions of animals and human-animal relations throughout education construct how we perceive animals, which subsequently affects how we treat them. Thus for the students who go on to become researchers, their pedagogical exposure to

dissection and animal experimentation could influence how they come to practice these experiments and whether or not they choose to use animal models (e.g. Deguchi et al., 2012; Pedersen, 2010). These understandings from a critical animal pedagogy have largely been absent in a Canadian context. While the Canadian work of Oakley (2013), Ellis et al. (2010), and Bowd (1993), begins to detail students' perceptions of animal dissection and experimentation, it fails to address the future implications of animal experimentation pedagogy on the next generation of researchers, which my project explores.

Chapter 3: Research Methods

In order to address my research questions (i.e., "How do students experience animal experimentation, its teaching, and its place in the curriculum?" and "How do these experiences potentially influence students' understandings of animal ethics?"), I employ a constructivist-interpretivist methodology to my project (e.g. Schwartz-Shea and Yanow, 2012). According to Schwartz-Shea and Yanow (2012), a constructivist-interpretivist methodology centers on the belief that multiple constructed social realities can exist, rather than one particular "truth" in research. As I am examining students' perspectives and experiences of animal experimentation, this methodology is important as it allows me to acknowledge that participant narratives will vary, based on cultural, political and experiential perspectives of each interviewee, and that my interpretation is not a singular "truth". Another strength of this approach for my project, as opposed to others such as a realist-objectivist methodology (e.g. Schwartz-Shea and Yanow, 2012), is that it does not falsely presume that the researcher is neutral and objective to the research. As I chose this project based on my interest in animal experimentation pedagogy, I am not entering this research objectively, rather I am bringing my own subjective positionality to my project. Therefore, the idea of multiple truths, as opposed to a singular truth, is important because the interpretation of the data can vary depending on the positionality of the researcher. I will subsequently outline the methodological steps that I have taken throughout my research project, with respect to my research design, sampling techniques, interview process, data analysis strategies and reflexivity, thus emphasizing my research process following Research Ethics Board (REB) approval.

Research Design

In applying a constructivist-interpretivist methodology, I use qualitative-interpretive methods to enact my research design (e.g. Schwartz-Shea and Yanow, 2012), which I subsequently outline and reference throughout this chapter. Therefore, my project draws on qualitative-interpretive research methods (e.g. Schwartz-Shea and Yanow, 2012), in which I have conducted in-depth interviews (approximately one hour in length) with six Brock University students enrolled in the Faculty of Mathematics and Science (specifically from the Biological Sciences and Neuroscience programs). I have chosen in-depth interviews, as opposed to other methods, such as a critical discourse analysis of curriculum or participant observation in lab settings, because my primary goal is to generate an understanding of students' perceptions and lived experiences of animal experimentation, which requires in-depth discussion with participants. Speaking to students in individual interviews, rather than focus groups, is also important for my research because it will preserve the anonymity of students who might feel uncomfortable speaking critically about animal experimentation in front of others.

Furthermore, in my analysis of animal experimentation pedagogy at Brock University, I have specifically chosen to interview students, as opposed to interviewing professors, in order to better understand the socialization process and experiences with early pedagogy of animal experimentation: The experimentation practices learned in university form one important site in the knowledge development of future researchers; such knowledge influences their techniques, values, beliefs and treatment of non-human animals (e.g. Eadie, 2011). As Pedersen (2010) argues, when it comes time for students to confront something morally controversial, such as using animals in education, they are often easily swayed to align with figures of authority, such as their teachers.

Additionally, my interest in interviewing students stems from the noticeable gap in previous literature to account for student voices in the broad conversation of animal experimentation. Although such practices have been widely debated (e.g. Guerrini, 2003; Knight, 2011; Lankford, 2009; Rupke, 1990), we nonetheless know very little about students' perceptions and experiences of learning animal experimentation, with some notable exceptions (e.g. Pedersen, 2002; Birke et al., 2007; Deguchi et al., 2012; De Villiers, 2012). According to Giroux (1997), the concept of student voice can be defined as the individual or collective perspectives of students; students' sense making of their lives and school, which is often reduced to something that is managed, administered, measured and controlled. In order to account for student voice in my research, I decided to speak with students directly to understand their perspectives and experiences learning and engaging in animal experimentation. Subsequently, interviews were a necessary process to account for student voice, as they allow me to conceptualize how students perceive animal experimentation pedagogy.

Furthermore, after reviewing online the departments, programs, and course descriptions offered at Brock University, and speaking with a friend in applied health sciences, I found that the Faculty of Applied Health sciences and the Faculty of Mathematics and Science, as well as the Psychology program, are the ones that predominantly engage in animal experimentation. Since I was particularly interested in interviewing students with direct experience participating in animal experimentation, I specifically chose to seek participants from these departments and programs. Consequently, this criterion was clearly outlined in my sampling process, as a means of recruiting suitable participants, which I will subsequently discuss.

Research Sampling

In the process of recruitment, I used multiple sampling techniques to find participants for my research, including purposive sampling (Teddlie and Yu, 2007), quota sampling (Acharya, Prakash, Saxena & Nigam, 2013), and snowball sampling (Acharya et al., 2013). Since my aim was to attract a very specific sample of students at Brock University (who are in their undergrads in the Faculty of Applied Health Sciences, the Faculty of Mathematics and Science and/or Psychology), I used purposive sampling by placing posters around the school to solicit possible participants interested in being interviewed. Furthermore, my research focused on undergraduate students, as opposed to graduate students, because I want to examine their early socialization and experiences of animal experimentation. Graduate students, having already completed their first four years of undergraduate education, could potentially have very different thoughts and experiences than undergraduate students, from being socialized in animal experimentation pedagogy for much longer. Therefore, I specifically mentioned these criteria on my posters to attract my target sample population.

My sampling process took approximately three months in total, and consisted of four rounds of placing recruitment posters around the Brock campus. The recruitment posters included my email address as contact information; therefore, all communication with prospective participants occurred through email. The response to my recruitment posters was fairly strong, with approximately thirty students contacting me during my sampling period. However, after sending out follow up emails, inquiring about respondents' year of study, program and whether they had any experience with animal experimentation at Brock, I found that many students interested in participating were not in the above mentioned departments and programs, and did not have any experience with animal experimentation. In addition, I also had a few graduate

students inquire if they could still participate even though they were no longer in their undergraduate programs. While I sought participants from the departments and programs under the Faculty of Applied Health Sciences, the Faculty of Mathematics and Science, and/or Psychology, all six of my participants ended up being from the Faculty of Mathematics and Science, specifically in the Biological Sciences and Neuroscience programs. Furthermore, the age range of my participants was between nineteen and twenty-two years of age.

I found it interesting that despite having stated the criteria for participants in my posters, I received more interest from students outside of the health sciences and/or from students who have never engaged in animal experimentation. This was of particular interest to me because some of the previous studies on student perceptions of animal experimentation surveyed or interviewed students from across disciplines outside of the sciences, and regardless of whether or not they had ever participated in animal experimentation (e.g. Baluch and Kaur, 1995; Hagelin, Hau and Carlsson, 1999; Ozen and Ozen, 2010). In my study, as I am examining animal experimentation pedagogy, I felt that it was important to maintain my criteria of speaking only with students in the sciences who have participated in animal experimentation. However, as past studies and my recruiting experiences have shown, students outside of the sciences are interested in voicing their opinions on the topic of animal experimentation as well.

Additionally, my interview quota consists of six students, four women and two men. While I initially hoped to have equal numbers of men and women in my sample, as previous research has suggested differential perceptions between genders (e.g. Birke et al., 2007), I found that the majority of students who contacted me regarding their participation were women. Thus, in order to complete my interviews in accordance with my timeframe for my project, I chose to proceed with the participants that I had.

Furthermore, I also employed snowball sampling, which I intended on using if I could not attract enough participants using the posters. A friend of mine, who is a Master's student at Brock, has a friend doing their undergraduate degree at Brock in the health sciences, and offered to inform them of my research project and pass along my contact information. Therefore, I was able to snowball sample using this connection, after not receiving enough suitable participants through the posters. Additionally, at the end of each interview I asked participants if they had any peers in their programs who they thought might be interested in being interviewed, and to pass along my contact information, if they felt comfortable doing so. Using multiple forms of sampling allowed me to maximize my chances of accessing participants. Furthermore, as an incentive for my interviewees, I gave each participant a thirty-dollar gift card to the Pen Center to compensate for their time and participation.

Interview Process

Throughout my interview process, I employed many techniques to ensure each interview was conducted with consistent organization. In this section, I will begin by highlighting the logistics of my interview process, namely the place, length and overall structure of my interviews. Then I will expand on the consent forms that each participant agreed to prior to taking part in the interviews, and my process of writing field notes following each interview. Next I discuss my transcription period, and the member-checking process that followed to ensure participants felt accurately represented in their interviews. Finally, I discuss the unforeseen issues that happened to arise while I was conducting the interviews, to highlight the challenges that I faced in my interview process.

Out of the six interviews that I conducted, five took place at Brock in a private meeting room, and one took place via Skype while my participant and I were in the privacy of our homes. Additionally, each interview lasted approximately one-hour in length and was recorded with consent from participants. In the preparation for interviewing students, I wanted to maintain flexibility by using different questions depending on their responses. Building responsiveness into my interview questions allows my research to maintain an openness to various perceptions and circumstances, while acknowledging that the social world is dynamic and fluid rather than fixed and stable (Schwartz-Shea & Yanow, 2012). For my research, this meant that rather than using a standardized set of questions, I wanted to acknowledge that individuals' perceptions would vary based on their experiences, and thus require different follow-up questions based on their answers. Subsequently, by keeping my follow-up questions flexible it allowed my participants to voice their perspectives and guide the conversation in the direction that they wanted.

In order to confirm that participants understood what was involved in their participation, the potential benefits and risks of participating, and their confidentiality, I used informed consent forms, which participants read and signed prior to each interview. However, in the case of the interview conducted via Skype, I sent the participant a PDF document of the consent form before the interview, and received verbal consent at the beginning of the interview. Furthermore, I ensure confidentiality through the use of pseudonyms when discussing participants in my data analysis (e.g. Orb, Eisenhauer and Wynaden, 2000).

I also engaged in consistent field note documentation after each interview, to reflect on what surprised me or interested me, and to speculate on themes that could ultimately help me to answer my research questions. Furthermore, by taking field notes following each interview, my

initial thoughts and reactions to the interviews were immediately captured, so as not to lose or forget any important details for my data analysis. As Schwartz-Shea and Yanow (2012) explain, field notes help to provide context of interviews and interactions for a researcher's sense-making later on. While I did write down brief notes during the interviews, I chose to wait until after the interviews before taking substantial field notes, because I did not want to be disruptive of the interpersonal conversations between my participants and I (Schwartz-Shea and Yanow, 2012). In addition, these field notes include preliminary themes that particularly stood out to me, within each individual interview, as well as reoccurring themes between interviews and/or major differences.

Upon completion of my interviews, I began transcribing each interview verbatim. Following my transcription period, I sent each participant a document of his or her transcribed interview for member-checking. The process of member-checking occurs when a researcher presents data, either transcripts or interpretations, back to some or all of the participants for potential feedback, and is designed to strengthen credibility of the data, through participant involvement (Varpio, Ajjawi, Monrouxe, O'Brien and Rees, 2017). However, as Varpio et al. (2017) explain, some have critiqued the use of member-checking for privileging the participants' accounts over the researcher's interpretation and analysis of all of the accounts combined. This can be problematic as the researcher uses their own methodological and theoretical expertise to interpret the data, whereas the participants do not have access to all of the data and may not be fully aware of the epistemological foundations of the researcher (Varpio et al., 2017). Therefore, I chose to member-check the transcripts, rather than the data analysis, to respect the participants' accounts of the interviews, while also respecting my own epistemology and interpretations. I

gave participants a two-week period to respond with any changes or clarifications; however, none of them responded with any issues to the original transcripts.

Since my research could be considered controversial, especially to some students who have been socialized in their education to believe that animal experimentation is necessary and essential to learning and scientific advancement, I was aware that unforeseen ethical issues might arise during the interviews. For example, in one interview a participant began asking me questions about my views on animal experimentation. When this happened I was conflicted on how to respond, because while I did not want to lie to that participant, I also did not want to say too much in case my perspective would have influenced what they felt they could tell me for the rest of the interview. In addition to that incident, during another interview, I had a participant who said something that contradicted what other participants were telling me, and while I wanted clarification on this, I knew that it was not ethically appropriate to disclose to that participant what others have said. Therefore, the process of ethics extended beyond being granted approval from the Research Ethics Board (REB), and it was important to maintain a consideration of ethics into my interview process, as unforeseen ethical issues, and issues that could have potentially jeopardized the integrity of my study, can and did arise.

Data Analysis

In the analysis of my data, I am approaching epistemological considerations outlined by Mauthner and Doucet (2003) and Schwartz-Shea and Yanow (2012), and the process of 'knowing'. Since knowledge is grounded historically and contextually (Mauthner and Doucet, 2003), I analyze my data with this consideration in mind. I am also mindful that my analysis is my own interpretation of the data, and it does not necessarily mean that my interpretation is all

encompassing of the respondent's narrative (Mauthner and Doucet, 2003). As previously mentioned, in a constructivist-interpretivist methodology, a singular "truth" cannot be attained, therefore a researcher's meaning-making is not centered on "getting it right", but rather on interpretive sense-making and contextuality (Schwartz-Shea and Yanow, 2012). By differentiating between the respondent's narrative and my sense-making of that narrative, I am able to approach my data analysis without fearing that I am not capturing the whole truth of the respondents. I acknowledge that my interpretation of the data could be very different from how another researcher might interpret it; therefore I approach the data with this consideration in mind. Furthermore, this understanding influences how I approach the presentation of my data, because I am writing my interpretation of the data and using participant accounts to substantiate and explain my interpretations.

Furthermore, in this thesis I use an inductive approach to analyze my data, following the interviews and transcription period, to allow my interpretations to arise from the data, rather than the deductive approach of testing the data against preexisting theory and hypotheses (e.g. Thomas, 2006). However, I would like to acknowledge a critique made by Schwartz-Shea and Yanow (2012) regarding this approach; when we claim that "findings" will emerge from the data or field, it presumes that a researcher is entering the field as a blank slate, without prior theoretical or experiential knowledge. This is problematic within a constructivist-interpretivist methodology because while it is important for researchers to understand their participants' perspectives and meaning-making, they are not simply conduits of their participants' concepts and perspectives (Schwartz-Shea and Yanow, 2012). Therefore, I recognize that while I did not begin my research to test my data against preconceived hypotheses, I did enter my research with

certain theoretical and experiential knowledge. This will be further recognized in the following subsection on reflexivity in order to discuss these issues transparently.

The initial technique that I am using to analyze the data is to read the transcripts several times using a coding process, and develop categories for various themes in the data (e.g. Thomas, 2006). As previously mentioned, knowledge is grounded both historically and contextually, and my data analysis is simply my interpretation of the participants' accounts (Mauthner & Doucet, 2003). Therefore, in my research I focus on contextuality of the respondents (i.e., their demographic, year of study, and program), and the institution (Brock University). While there is an overarching institution that provides guidelines for all animal experimentation in Canada (CCAC), the specific educational practices of each university, each department, and each professor will likely vary.

Therefore, in my discussion and data analysis, my research focuses on contextuality and specificity, rather than generalizability. Mauthner and Doucet (2003), using Donna Haraway's term, explain that theory results in 'situated knowledges', as knowledge is socially, culturally and historically rooted. Thus, the knowledge developed through research is contextually situated. In the case of my project, the situated knowledges that my research generates are contextually dependent on the particular teaching styles and content of the professors that my participants have had. Therefore my research is context specific, as the contextual teachings can vary from each institution and the way students' perceive that knowledge can also vary. Since my research incorporates interpretive research design elements in my data analysis, these contextual and situated knowledges will influence my interpretations and meaning making. Furthermore, there cannot be a single "truth" in my research claims because it is dependent on the situated knowledges of the professors in the health and biological sciences, and the meaning making of

that knowledge by the students that I interviewed. Subsequently, as I am bringing my own situated knowledge to my interpretation of the data, I acknowledge that the research claims would also vary depending on who is interpreting it and what epistemic community they are coming from. As a result, I have approached my research with these considerations in mind, and as I interpret and present my data I avoid absolutist claims and sweeping generalizations beyond my sample. Furthermore, I compare my situated data and interpretations to other work, in order to connect and support my claims with those from other contexts.

Reflexivity

In positivist social research, the trustworthiness of knowledge claims is evaluated based on reliability, replicability, and validity (Schwartz-Shea and Yanow, 2012). This is problematic to interpretive research designs because once again it assumes that there is a single truth that can be known, validated, and replicated by any other researcher doing the exact same processes (Schwartz-Shea & Yanow, 2012). In my research I focus on meaning making and contextuality when analyzing my data, acknowledging that there is not a single way of interpreting student perceptions of animal experimentation, and I am using reflexivity to establish trustworthiness in my research (e.g. Schwartz-Shea and Yanow, 2012). According to Schwartz-Shea and Yanow (2012), reflexivity pertains to a researcher's consideration and engagement in their own sense-making, with respect to how their situated knowledge may affect and relate to their research analysis and conclusions. Furthermore, by engaging in reflexivity throughout the research process, it can establish trustworthiness through the "transparency of knowledge generation" (Schwartz-Shea and Yanow, 2012, 103). While reflexivity may appear to reveal things that could compromise trustworthiness, the transparency strengthens it because it allows for the assessment

of a researcher's knowledge generation (Schwartz-Shea and Yanow, 2012). Therefore, by being forthcoming and reflexive about how my own pedagogical experiences and positionality can influence my interpretation of the data, I am enhancing the trustworthiness through transparency and acknowledging the multiple truths that could exist depending on the positionality of the researcher.

Therefore, the incorporation of reflexivity into my research process is essential as I attempt to understand students' lived experiences of animal experimentation, which will draw attention to various potential ambiguities and the multidimensional processes of meaning-making (Schwartz-Shea & Yanow, 2012). These processes of meaning-making around animal experimentation, will be different based on a student's particular history, context, and experiences. Through my application of critical pedagogy, I incorporate reflexivity into my research process by questioning and being critical of my knowledge production, in order to reflect throughout my research on how and what knowledge I am generating, and what epistemological and methodological assumptions I am bringing into my research (e.g. Cunliffe, 2002; Cunliffe and Jun, 2005). Part of this reflexivity includes questioning my positionality as a student, and my own pedagogical education as an undergraduate and Master's student, and also as an animal rights advocate, being mindful of the assumptions I have regarding animal exploitation. This means, while I am conducting the interviews and interpreting the data, I will be conscious of the fact that students' perceptions of animal experimentation are a reflection of their socialization and education.

Furthermore, as I examine pedagogy and its influence on student perspectives and experiences, I also need to acknowledge that my perceptions of animal experimentation have also been shaped through my learning and education. Therefore, through my interest and use of

critical pedagogy I incorporate reflexivity into my research process by questioning and being critical of my knowledge production. To a certain extent we are a product of our educational process, and reflexivity and critical pedagogy allow me to analyze my own sense-making and what particular educational circumstances have affected it. My early socialization and educational experiences, in elementary and secondary school, involved a pedagogy and hidden curriculum that legitimized animal uses for food, entertainment, clothing and animal experimentation. Furthermore, my education involved animal dissection in secondary school, and a pedagogy of acceptance and necessity of this practice. Conversely, as a former Sociology undergraduate student concentrating in Critical Animal Studies, my situated knowledge of animal experimentation has been shaped theoretical by Critical Animal Studies (CAS) scholarship. Therefore, I continuously impose a self-reflective lens to my research process and conclusions, to hold myself accountable for my research and those I am studying (e.g. Schwartz-Shea & Yanow, 2012).

Additionally, while I am an animal rights advocate, I acknowledge that my thesis is anthropocentric. By centering my attention on student voice, specifically student perceptions and experiences of animal experimentation, I am to an extent understating the perspectives of the animals being used. However, I do account for them in my use of CAS as a theoretical framework in my data analysis to defend their interests. Through the framework of CAS I challenge the use of animals as research objects, advocate for the abolishment of animal experimentation, and promote non-animal alternatives as a replacement. Furthermore, animal experimentation pedagogy could significantly influence students' perspectives on the use of animals in education and research, which would subsequently impact the perspectives of future professors and/or researchers, and their use of animals. Therefore, by focusing my attention on

students' perspectives and experiences of pedagogy, I offer a starting point in the larger issue of animal use in science, which has significant implications for millions of future animals.

Interview Questions/Conclusion

In my research, I critically examine students' perspectives and experiences of animal experimentation pedagogy, and the validity of this practice in university education. In the abovementioned discussion, I have explored the ways that I am incorporating a constructivist-interpretivist methodology into my project. Throughout my research process, and particularly during my interpretation and analysis of the data, I include considerations of context, knowledge generation, and the multiplicity of meanings as discussed above. Furthermore, I acknowledge that my data and interpretations are situated in the context of Brock University. Therefore, as I discuss my research on animal experimentation through my data analysis, I am specifically focusing on how this practice is learned through pedagogy in this context.

In order to attend to this examination, my research questions (i.e., "How do students experience animal experimentation, its teaching, and its place in the curriculum?" and "How do these experiences potentially influence students' understandings of animal ethics?") highlight the perspectives and experiences of students engaged in animal experimentation at Brock University. Furthermore, in order to explore my driving questions, the interviews focus on the students' experiences of learning animal experimentation and their perceptions of this practice. For example, "What and how have you been taught about animal experimentation?", "What kinds of animal experimentation practices have you engaged in? How do you feel about these practices, the animals, and your involvement?", "What role do you see animal experimentation playing in your education?" and "What do you think influences how you feel about animal experimentation

and its value?". As part of my analysis of their answers, and my larger examination of how students are learning animal experimentation in universities, I analyze how students' perspectives are shaped by animal experimentation pedagogy. I am most interested in gaining insight into how students conceptualize animal experimentation in their university education, and in providing a critical examination of students' experiences of animal experimentation pedagogy.

Additionally, I also explore students' understandings of the animals, to learn about how the animals are treated inside and outside of experimentation. This involved asking students, "Where do the animals come from?", "How are they housed?", "How many times are the animals experimented on before they die?", "How do you think animals are treated at Brock?", and "How have you been taught about how you should treat animals?". These particular questions not only account for students' knowledge of the animals used at Brock University, but also the lives and conditions of the animals. Moreover, these interview questions provide an invaluable snapshot of the lived experiences of students learning about animal experimentation and the associated philosophies, as well as the lives of the animals used in animal experimentation.

Chapter 4 – Data Analysis

In my attempt to understand students' perspectives and experiences of animal experimentation, I present the following analysis of interviews with six Brock University students who have engaged in this practice as a part of their education. I begin by outlining the theoretical frameworks that I will use to analyze and critique my data, namely critical pedagogy and Critical Animal Studies. Then I discuss how animal experimentation is taught at Brock University, based on the information provided from participants, to contextualize the rest of my data and to provide an overview of the students' educational settings. From there, I will begin with a thematic analysis of my data, by examining the prevalent themes that were commonly discussed across the six interviews, to examine how students experience animal experimentation, its teaching, and its place in the curriculum, and how these experiences influence their understandings of animal ethics. These themes include, acceptability, misconceptions in the debate on animal experimentation, gender differences, ethical ambiguities, absolution of culpability, lives of luxury, objectifying and obscuring language, and marginalization of alternatives. Then I further address the pedagogical influences and impact of instructors on students, which shaped their perspectives and understandings of animal experimentation. Finally, I will turn my attention back to my frameworks of critical pedagogy and Critical Animal Studies for a theoretical reflection of my data, before concluding this chapter.

Theoretical Frameworks

The two primary theoretical frameworks I use in my project are critical pedagogy, and Critical Animal Studies (CAS). I first use critical pedagogy to examine the pedagogical

relationship between teachers and students in classes where animal experimentation takes place. Within this framework I use the concepts of student voice (e.g. Giroux, 1986; Taylor and Robinson, 2009) and the hidden curriculum (e.g. Giroux, 1983; Taylor and Robinson, 2009; Yannuzzi and Martin, 2014) in my analysis of animal experimentation pedagogy. Drawing on CAS I examine the exploitative human-animal divide that permits animal objectification and animal experimentation (e.g. Nocella, Sorenson, Socha and Matsuoka, 2014). CAS allows me to incorporate an intersectional and interdisciplinary approach to my research (e.g. Nocella et al., 2014). Under the CAS framework I also use humane education to examine the alternative educational practices that can be used to develop more compassionate attitudes towards animals (e.g. Pedersen, 2010; Eadie, 2011), which will be further discussed in Chapter Five. I expand on these theoretical lenses below.

Critical Pedagogy

Critical pedagogy is an educational approach that challenges the pedagogical interrelationships between culture, power, and ideology to unveil oppressive institutional structures in educational settings (Darder, Baltodano and Torres, 2003). I use critical pedagogy in three main ways: to promote critical consciousness, to address student voice (as well as animal voice, which will be discussed in the following subsection), and to examine the hidden curriculum in standard pedagogy.

Since the aim of critical pedagogy is to challenge structures that lead to oppression, alienation, and subordinate practices in education, critical consciousness in students is central to transform the reproduction of these structures (Pedersen, 2010). As Freire (2000) explains, students are often taught using the banking concept of education, in which students are viewed as

'containers' waiting to be filled with knowledge. He problematizes this because the more students are taught with the banking concept, the less they can develop their own critical consciousness (Freire, 2000). While critical consciousness would allow students to become active transformers in the social world, the banking concept imposes a passive role on them in which they tend to accept and adapt to the world that is taught to them (Freire, 2000). This connects to my research interest in examining how students are encouraged to think about animal experimentation. As Pedersen (2010) argues, (at least some) students willingly accept and align with the philosophies presented to them by their teachers. Using a Freirean perspective, I suggest that this is due to their exposure to the banking concept of education. By directly speaking with students, and hearing how they are taught and how they conceptualize animal experimentation, I will further understand how pedagogy influences their perceptions and educational experience with this practice.

In Taylor and Robinson's (2009) analysis of Freirean critical pedagogy, empowerment is centralized as the process that arises from liberatory learning, through the relationship between epistemology and power. This empowerment is crucial to student voice in praxis, from which students can break from oppressive pedagogy by problematizing accepted knowledge and questioning the roots of oppressive social forces in education (e.g. Taylor and Robinson, 2009; Freire, 2000). According to Giroux (1986), the voice of students in education is often reduced to something that is measured, administered and controlled, and often ignored for efficiency's sake. In educational pedagogy, the traditional paradigm between teachers and students establishes the power relations of the teacher as authority and the student as unassertive and obedient (e.g. Yannuzzi and Martin, 2014). Due to the unequal power arrangements between teacher voice and student voice, students are taught to be compliant with educators and educational practices

through domination (Giroux, 1983). As Yannuzzi and Martin (2014) suggest, a power-sharing paradigm should be used to interactively manage teacher voice and elevate student voice. I subsequently use this analysis of student voice in my research to account for the ignored perspectives in standard pedagogy, and to understand how the power dynamics in the classroom can influence student compliance, perceptions, and navigation of animal experimentation.

While student voice asserts student empowerment, the hidden curriculum in standard pedagogy is used to reproduce material, social, and economic discourses of capitalism while producing compliant persons to work within the system (e.g. Taylor and Robinson, 2009). In the hidden curriculum, tacit mechanisms occupy curriculum to reproduce and transmit norms, values, and beliefs in the interest of dominant groups (Giroux, 1983). Governing bodies easily influence curriculum through their increased state control of pedagogy (Yannuzzi and Martin, 2014). Giroux (1983) examines the relationship between knowledge and power within the hidden curriculum, questioning who or what governs the selection of knowledge, and knowledge in whose interest. Furthermore, the concept of the hidden curriculum allows me to examine the undercurrents of objectification and commodification in animal experimentation pedagogy that justify and permit the use of animals, as well as the implicit norms pertaining to human-animal relations.

Critical Animal Studies

The second theoretical framework that I use is Critical Animal Studies (CAS). In relation to my research, CAS challenges two main fields of theory: animal studies rooted in animal experimentation in the hard sciences, and human-animal studies that reinforces the binaries between humans and animals, which views animals as objects (Nocella et al., 2014). I draw on

CAS scholars as I critique the use of animal experimentation in education, and subsequently challenge the human-animal divide that exists and permits the objectification of animals in education. According to Nocella et al. (2014), CAS has roots in critical theory and challenges systems of domination, such as capitalism. This element of CAS is useful in my analysis of the hidden curriculum and critical pedagogy's examination of power, which posits that mechanisms in education tacitly work in the interests of capitalism (e.g. Giroux,1983; Taylor and Robinson, 2009; Yannuzzi and Martin, 2014). CAS also seeks to abolish systemic exploitation and domination by engaging in praxis, to connect theoretical scholarship and street-level activism (e.g. Nocella et al., 2014; Glasser and Roy, 2014). Therefore, I incorporate this into my discussion of how to move forward in Chapter Five, subsequently drawing on humane education.

According to Nocella et al. (2014) and Colling, Parson and Arrigoni (2014), CAS is an interdisciplinary and intersectional field of liberation, interconnecting human, nonhuman animal, and earth liberation efforts. The concept of intersectionality is important for my research because I attempt to create a liberatory dialogue for both students and nonhuman animals, by centralizing student voice, while also advocating for animal voice and the abolishment of animal experimentation in education. Furthermore, I use intersectionality to acknowledge the entanglement of human and nonhuman animal oppression through capitalism and speciesism (e.g. Belcourt, 2015; Corman & Vandrovcová, 2014; Nocella et al., 2014), as well as in the hierarchical ideologies of teacher and student, and human and animal relationships.

In keeping with the concept of intersectionality, I use critical approaches to humane education to bridge the work of critical pedagogy and critical animal studies, as many previous scholars have done (e.g. Pedersen, 2010; Eadie, 2011; Kahn and Humes, 2009; Andrzejewski, 2003; Kahn, 2003). According to Eadie (2011), humane education is a process that can

encourage an understanding of respect and compassion for people, animals, and the environment. Recognizing the interconnectedness of all living beings is important when seeking long-term strategies for alleviating animal suffering (Eadie, 2011) and promoting animals' wellness. In order to incorporate this framework into a discussion on animal experimentation in particular, Eadie (2011) and Pedersen (2010) suggest how humane education can be done by educating students on animal welfare issues, and providing education of alternatives to animal models. Conversely, Kahn and Humes (2009) use "total liberation pedagogy" to work intersectionally against all oppressions, for human, animal, and ecological sustainability. This liberation pedagogy allows me to challenge animal experimentation as a harmful practice against nonhuman animals, as well as the pedagogy that necessitates the use of animals in education. While student voice is centralized in my research, I acknowledge the importance of incorporating animal subjectivity and voice in order to disturb and challenge the anthropocentrism in animal experimentation pedagogy (e.g. Corman, 2016). The incorporation of animal voice is also important in pedagogy to transcend the common focus on animal suffering, and the notion of animals as "voiceless", to include an intersectional pedagogy that prompts students to think about the social, cultural, and emotional lives of nonhuman animals (Corman & Vandrovcová, 2014). While a more thorough examination of intersectional pedagogy and humane education will be addressed in Chapter Five, these concepts have undoubtedly influenced my current analysis of the data within this chapter.

How is Animal Experimentation Taught at Brock University?

I began this project questioning how animal experimentation is taught in university settings, in the hopes of understanding the educational process of students in the sciences

engaging in animal experimentation. Through the course of the interviews, I learned that, in my sample, animal experimentation was mainly taught in the lab setting, with very little discussion of animal experimentation in the lecture settings. While students did assert that the lab and lecture components are closely related, five out of the six students explicitly outline their experiences of learning animal anatomy, physiology and theory in their lectures and then applying that information to the animal experiments in their labs. Therefore, the lab setting is where concepts, skills and techniques are applied in hands on experiments. However, several students also mentioned that while animal experimentation is not as explicitly discussed in lecture, the content did cite studies that used animal experiments. Thus, animal experimentation is further normalized implicitly through the inclusion of animal research studies in course content, which is part of the hidden curriculum to teach students about the acceptability of animal use.

Additionally, various online components are used in preparation for animal experimentation aside from learned concepts in lecture and lab settings. There appears to also be an online domain for many of these students' courses, in which animal care and instruction modules and quizzes are conducted prior to experiments, to ensure that students are prepared for the labs upon arrival. Also, videos and online simulations are sometimes shown in lab, or made available prior to lab, so that students know what to expect and have a visual example to follow. Subsequently, some labs involve students directly engaging in animal experiments, either individually or in small groups, while other labs involve observations rather than direct participation. These observational experiments involve students attending lab to observe an instructor conduct an experiment on an animal. Therefore, there are various ways that animal experimentation is taught, and multiple in-class and online settings for this learning to take place.

Furthermore, within the lecture and lab settings, students typically have three different instructors; a professor in lecture, and a lab demonstrator and teaching assistant in their labs. This was consistent across programs, among the four students in neuroscience and two students in biological sciences. Based on the information provided from participants, it appears that the professor provides the lectures, while the lab demonstrator sets the criteria for labs each week and communicates with the professor to ensure fluidity between lectures and labs. Subsequently, the teaching assistant assists the lab demonstrator in labs, and is in charge of fielding student questions and marking lab reports or assignments. These understandings are significant because they help to conceptualize where and how this learning takes place in animal experimentation education at Brock. Therefore, I will use the broad term 'instructor' to encompass professors, lab demonstrators and teaching assistants throughout my analysis, except when explicitly specified in participant accounts, as it appears that animal experimentation pedagogy is taught by more than one teaching figure. While professors oversee the courses, and thus hold the most authority, I use the term 'instructor' to acknowledge that animal experimentation pedagogy is taught, and thus likely influenced by, multiple instructors in more than one setting.

While this information certainly aids in mapping the educational settings in which students are taught animal experimentation, specific information on what experiments are conducted on animals at Brock is largely unavailable. Since Brock is not required to disclose details on what animal species are used, what types of experiments are conducted, and how many animals are used annually, it is difficult to establish definitive information. In some of the interviews students do reference specific species used or experiments that they participated in, which will be noted in the thematic analysis, however there is a general lack of transparency around this information at Brock, as well as other universities and institutions. This further

substantiates the need for more in-depth research on animal experimentation in universities, to forge greater transparency, which will be discussed in Chapter Five.

Thematic Analysis

Following my analysis of the data, I categorized several prominent themes that appeared across the six interviews. I will subsequently discuss the prevalent themes and their relevance to the study of student perceptions and experiences of animal experimentation. The first theme that I will discuss is acceptability, to examine the varying degrees of acceptability that students expressed based on the use of animal experimentation (e.g. scientific research, cosmetic testing, education). Next I will focus on the misconceptions that students believe in the debate on animal experimentation, specifically the transferability of animal experimentation results, false dichotomies and homogenization of the scientific community. Thirdly, I note the students' views of gender differences in animal experimentation pedagogy, and whether men and women feel differently about this practice in education. Following gender differences, I discuss the apparent ethical ambiguities in students' perceptions of what is considered "ethical" treatment in animal experimentation. Subsequently, I examine the various ways that students appear to absolve themselves from culpability in the use of animals for educational purposes. Then I examine the ways that students perceive animals as having a supposed 'life of luxury' (e.g. being transported in private planes and limousines). Then I discuss the objectifying and obscuring language that was used in the interviews; and finally I explore the marginalization of alternatives to animal experimentation in the students' education. Furthermore, these themes have influenced my theoretical understandings and reflection, which will subsequently follow.

Acceptability

I begin with the theme of acceptability, as instilling an acceptance of animal experimentation in students is a crucial first step in having students participant in this practice. Animal experimentation is a broad practice that can take many different forms in various settings and institutions. While my research focuses on students' perceptions and experiences of animal experimentation in educational settings, this practice is also used in various research fields for applied research, toxicology, behavioral studies, military defense research, and cosmetic testing, to name a few. While I primarily aimed to understand students' perspectives of animal experimentation in education, it became a reoccurring theme for students to express where they draw the line of what is acceptable in animal experimentation more broadly. Throughout the interviews, students expressed varying degrees of what they consider acceptable for animal experimentation, most notably that research and education are necessary and acceptable, whereas cosmetic testing is not.

In *The Sacrifice*, Birke et al. (2007) examine how technicians, animal caretakers, graduate students and researchers express varying levels of acceptability and reservations regarding certain species and techniques used in animal experimentation. They found that research workers and scientists would commonly draw the line at experimenting on cats, dogs and primates, while rats and mice were considered more acceptable test subjects (Birke et al., 2007). Researchers' personal and inconsistent reservations of experimenting on certain species, exemplify a speciesist hierarchy that exists within animal research, in which the species that are considered closest to us, either evolutionarily or as companions, are more difficult to use. Similarly, Birke et al. (2007) posit that some scientists also draw the line at certain techniques, such as extracting spinal fluid from the neck and blood samples from the eye, or engaging in

long-term animal studies. Conversely, while Birke et al. (2007), found themes of differential acceptability based on species and technique as discussed above, I found that the most common variant on acceptability in my interviews was the purpose and kind of animal experimentation (e.g. medical research vs. cosmetic testing) being used.

Building on the previous research of Birke et al. (2007), all six participants explained how certain uses of animal experimentation were more acceptable and important than others. My participants, Aubrey, Devin, Rowan, Layla and Alma, all suggest that while animal experimentation is a pivotal part of scientific research, cosmetic testing was unnecessary. Devin explains that the perception of animal experimentation among fellow students is "that animal experimentation in research is fine, but then like in the cosmetic industry and stuff, they're [fellow students and faculty] like no that's not okay. That's just kind of how we're wired I guess." Similarly, Layla concludes that any use of animals is unnecessary when it is for "consumer products" such as cosmetics, or even clothing, because there are some companies that do not test on animals, which is therefore evidence that animal experimentation is not necessary in that industry. While students explain their criticism of cosmetic testing using the principle of 'if it can be done without using animals, then it should be done without using animals', it is inconsistent from their views on animal research more broadly. As previously mentioned, many alternatives exist in replacement of animal models for medical research and education (e.g. Jukes and Chiuia, 2006; Gruber and Dewhurst, 2002; Knight, 2011; Greek and Greek, 2010; Valliyate, Robinson and Goodman, 2012; Pedersen, 2002), thus the use of animals can be considered unnecessary regardless of its purpose. However, it is evident that these inconsistencies reflect what students are taught, as many of them were unaware and skeptical of alternatives, which I discuss under the subheading *marginalization of alternatives*.

Furthermore, when I questioned students on why they felt differently about cosmetic testing versus education and research experimentation, Alma explained that it is because we do not need cosmetics to live, while Aubrey added that "there's a level of cruelty that is associated with that [cosmetic testing]." Aubrey's comment of perceived "cruelty" involved in cosmetic testing stood out, as it implies that cruelty is absent in animal experimentation for education and medical research. This is problematic for three reasons; firstly, there is obvious cruelty in any process of animal experimentation. Secondly, quantifying and measuring cruelty between two broad forms of animal experimentation that can encompass a range of different experimental procedures is not realistic. Thirdly, condoning the animal experimentation practices that you do, while demonizing other forms of animal experimentation is reminiscent of what Birke et al. (2007) suggest as being a coping mechanism for the lab. Birke et al. (2007) examine how some scientists and lab workers adopt the coping strategy of viewing their own practices as being morally superior to the practices of those working in other lab settings, other countries, or other cultures. Therefore, this finding could perhaps shed light on students' disapproval of other forms of animal experimentation, while supporting it in their own educational endeavors, as a coping mechanism used to disassociate with the criticisms of animal use.

However, while most students made reference to cosmetic industries' use of animal experimentation, there were some criticisms of education and research uses of animal experimentation as well. Noah explains that while he does believe that animal experimentation is useful and necessary in scientific research, its use in education at an undergraduate level is not necessary, stating that "we could get the same experience, since it is just theory to practice, without animal experimentation." Similarly, Devin reflects on her own educational training and while she is a proponent of animal experimentation, some of the experiments felt redundant

because they already knew what the outcome was going to be. Additionally, Alma expresses her concerns about the legitimacy of certain types of scientific research, namely behavioral research, explaining that,

> Sometimes if I read a study and it's like, "Okay, we found out a tiny little thing about behavior", and it's like well why do we care? Was it really worth using the animals for that? I definitely think that some scientific research is much more important than other aspects of the research.

Therefore, despite Noah, Devin and Alma supporting the practice of animal experimentation, they showed some reservation regarding specific aspects of this practice in their educational curriculum. However their continued support regardless of these reservations is likely due to their pedagogical influences, such as their professors' perceptions and the hidden curriculum, which I will later discuss.

Misconceptions in the Debate on Animal Experimentation

During the interview process and data analysis, it became increasingly apparent that many students were asserting similar arguments, in justification for animal experimentation, that were previously discussed in Chapter Two. Across *all* of the interviews, students repeatedly contend that animal models are transferable to humans, that it is better to use animal models because the alternative would be human experimentation, and/or that members of the scientific community do not oppose animal experimentation. Below I analyze student perspectives within these three themes, to examine how students' experiences of pedagogy reproduce these misconceptions that are commonly discussed in the animal experimentation debate.

Transferability

When asked what they were taught about animal experimentation and the transferability of animal models, students insisted that animal models are able to provide data that applies to

humans, and that animals are vital for medical breakthroughs. Several students indicated that since various animal species share similarities to us physiologically, it allows for transferable results to be extrapolated to human conditions. As Rowan explains,

> I don't know the percentages, or statistics behind it, but I do know that the reason rats are experimented on is because their brain structure is similar to that of humans, so that way whatever treatment would work… would affect the rats, would affect humans in a similar manner.

This perspective is similar to the accounts of other students, who use this to justify the use of animal models. Similarly, Noah discusses that he was taught that animal experimentation is an important part of research because we can mimic the physiological processes happening in humans, in animal models. In addition to these two accounts, Alma also asserts that "we would never do research on something if it couldn't be generalizable to humans." Therefore, at least some students believe that animal experimentation is effective and transferable in extrapolating data to aid humans. Furthermore, they are taught this despite the fact that many scholars and scientists (e.g. Anderegg et al., 2002; Birke, 2012; Fadali, 1996; Folescu et al., 2013; Greek and Greek, 2002) argue in opposition of animal experimentation for its unreliability and poor transferability, which students do not seem to be aware of.

Additionally, Aubrey explains how she was taught that without animal experimentation and the transferability of animal models to human conditions, life saving medical breakthroughs would not exist. As Aubrey describes:

> So we're taught that without having animals used as part of the experimentation process, as part of the research process, incredible breakthroughs would not have been achieved. For example like vaccines, we wouldn't know whether vaccines were… are safe for humans, and are able to be used or even effective, if we didn't have animal models to be based on.

Once again, this mentality that animal experimentation has led to medical breakthroughs, that otherwise would not have been possible, is often critiqued by scientists and researchers against

animal experimentation. Therefore, the extent of these medical breakthroughs attributed to animal experimentation is debatable, as many argue that high failure rates have actually misled many scientific discoveries (e.g. Anderegg et al., 2002; Birke, 2012; Fadali, 1996; Greek and Greek, 2010). For example, historically, animal studies originally misled researchers into believing that there was no correlation between smoking and lung cancer, despite there being evidence of this correlation in human patients at the time (Anderegg et al., 2002). Additionally, due to publication bias we are led to believe that animal experimentation is more significant than it really is, as the many failings of animal experimentation are not published, and are thus underestimated (e.g. Greek and Greek, 2010). Furthermore, while animal experimentation has played a part in the advancement of scientific knowledge, there is no way of knowing where we would be without animal experimentation in science and medicine (e.g. Brike, 2012; Greek and Greek, 2010; Luke, 2007). Therefore, due to the debates over the legitimacy of these claims from opponents of animal experimentation, it appears that students are misled and not educated on the issues and problems of transferability.

False Dichotomy: Animal Models rather than Human Models

In all of my interviews, students describe what I interpret to be false dichotomies regarding human and animal relations in the sciences. In relation to the transferability and usefulness of animal models to human conditions, each student interviewed equated animal experimentation to a preference of human health over animal lives, or ultimately doing what is in the best interest for humans. These arguments were often prefaced with a statement such as, "it's really important to use animals, as opposed to testing on people" (Alma), or "since they don't want to dissect a live human… [animals] would be the next best option" (Rowan). Therefore, participants' perceptions of animals are formed around the belief that since we cannot perform

human experimentation, animal experimentation is the closest acceptable option. As Layla explains, “it’s more ethical to test on animals than to test on humans because… especially when it comes to neuroscience with the brain and stuff, you can’t really open someone’s brain and just experiment on it.” Layla’s account indicates moral inconsistencies with regards to what can be considered ethical treatment of humans, versus ethical treatment of animals.

In accordance with Layla’s sentiments, many students suggested that the ethical obligations towards humans and animals vary greatly. For humans, as indicated in the abovementioned quotes from Alma, Rowan and Layla, ethical treatment means not conducting experiments, while for animals, students propose that ethical treatment means food and water, being cared for and minimum discomfort during experimentation. For example, Noah asserts that lab animals are treated ethically and that “they might not have the freedom of running wild, but they’re fed, they’re taken care of.” Similarly, Aubrey explains that the animal care technicians provide ethical care to the animals and are “ensuring they’re living good lives”, while Devin affirms that they have “unlimited food and water” and good living conditions. All of the students also assert that the animals’ discomfort is kept to a minimum during the experiments (e.g. providing animals with anesthesia), which they seem to equate to ethical treatment. This differential consideration of what is ethical for humans versus animals exemplifies the speciesist hierarchy and moral inconsistencies that exist in scientific research and education. It appears that students believe that in order to maintain the ethical treatment of humans, animals must be experimented on because “they can’t test on humans at the first stage” (Devin). This is significant in understanding how students’ perceptions of animals as research objects are shaped, specifically in how they justify animal experimentation through the perceived superiority of humans and inferior status of animals.

Furthermore, several of the abovementioned quotes, from Alma, Rowan and Layla suggest an assumption that if we could not use animals we would have to use humans as a replacement. As Rowan claims, "all of those experiments have been occurring on animals because they don't want to do it on humans." These presumptions from Rowan, Alma and Layla, that animal experimentation is used to spare humans from experimentation is problematic for two main reasons. Firstly, it dismisses the many alternative methods that are being used in replacement of human and/or animal experimentation. As previously outlined in Chapter Two, several researchers within the scientific community have spoken out against the use of animal models, and instead rely on alternative research methods such as computer simulations and models, statistical modeling, noninvasive imaging techniques, epidemiology, cell cultures and human volunteers (Folescu et al., 2013). Therefore, many non-human alternative methods could be employed in the absence of animal experimentation. Secondly, this belief expressed by students also assumes that human experimentation does not still occur in conjunction with animal experimentation. In actuality, human experimentation has always, and continues to, accompany animal experimentation in some way (Luke, 2007). Through historical examples such as the Tuskegee syphilis studies (e.g. Luke, 2007), and current examples of clinical drug trials in the Global South and developing countries (e.g. Kamat, 2014), we see how socially disempowered groups of people are used for experimental purposes. Kamat (2014) explains that currently there is a growing demand for human subjects in pharmaceutical markets for drug testing, and Western corporations are outsourcing these clinical drug trials to "Third World and developing countries" (China, India, Brazil and various countries across Africa). These experimental drug trials often target countries experiencing economic and political instability, with subjects who otherwise lack access to health care. Furthermore, many of these studies are

ethically problematic, often lacking adequate informed consent, and exploitative of marginalized and vulnerable racialized populations (e.g. Nundy & Gulhati, 2005; Kamat, 2014). Therefore, the presumption that animal experimentation needs to continue as a substitute for human experimentation is misinformed, as cases of human experimentation have historically and presently been used along with animal experimentation. While human experimentation does not occur in the same context or with the same open acceptability as animal experimentation, it is important to highlight that human experimentation is present to some extent.

As a result of the mentality that animal experimentation is used as opposed to human experimentation, students expressed a hierarchy between human lives versus animal lives. As Devin explains, "they can't test on humans as their first stage, you know? So I guess that's where it gets kind of put, like whose life is valued more, humans or animals?" Similarly Aubrey suggests this conflict between humans or animals as,

> understanding what the trade offs are, because it's easy to say that we should never experiment on animals, but then are we going to understand how drugs work in our body? Or how are we going to synthesize new measures that are safe to use in humans?

In both of these examples, students depict a choice between human health and animal lives, while also linking the pursuit of human health and wellbeing with the practice of animal experimentation. Therefore, these comments convey human health and animal lives as mutually exclusive, when in actuality many alternatives to animal models can be used to benefit human health, in addition to protecting animals from harmful experimental procedures.

Homogenization of the Scientific Community

As noted in Chapter Two, some within the scientific community seem to suggest that opposition to animal experimentation predominantly comes from the animal rights community, presupposing a unanimous agreement from the scientific community on this practice (as is

illustrated in the edited collection by Knight et al., 2009). While there are certainly proponents of animal experimentation in the scientific community, and opponents of this practice within the animal rights community, this assumption disregards the existence and perspectives of opponents within the scientific community. Referring back to Chapter Two, there is a large body of scholars and researchers within the sciences who are adamantly opposed to animal experimentation for various reasons (e.g. Anderegg et al., 2002; Birke et al., 2007; Fadali, 1996; Greek and Greek, 2010; Lankford, 2009). However, the false assumption that the scientific community is unanimously supportive of this practice pervades the perceptions of students.

In the literature review, I felt it was important to focus on the internal debate about animal experimentation within the scientific community, in order to illustrate the controversy using arguments beyond the broad moral and ethical concerns of animal exploitation generally. In the interviews with Aubrey, Noah, Devin, Layla and Alma, they seemed unaware of any internal debate on animal experimentation happening within the scientific community. Overall, students appear uninformed that some people within the scientific community oppose animal experimentation. For example, Alma notes, "it'd be hard to find someone who is very against it" in the scientific community, and Aubrey affirms that from her recollection "I haven't spoken to anyone who disagrees with it." Furthermore, Noah explains that within the sciences "I haven't heard any thoughts in regards to not believing in animal experimentation." While discussing the debates surrounding animal experimentation and its uses, students did admit to having knowledge of a debate, but continually asserted that the debate was between the scientific community and the animal rights community. Students, such as Devin, Layla and Alma, assert that in the debate on animal experimentation People for the Ethical Treat of Animals (PETA) and vegans are the opposition against this practice and the scientific community. When asked

whether they had ever experienced or heard of any debates on animal experimentation and where it was coming from, Devin explains, “like outside of my education, yeah like all the PETA stuff kind of thing.” Similarly, Layla asserts that it is “a lot of the PETA people all the time”, who oppose animal experimentation. In addition to the views of PETA as the opposition, Alma asserts that

> People who are in a science program and are using the animals, it’s not a big divide… But then I lived in a house with vegans and arts majors and stuff, and they would be fuming when I came home, and like it got to the point where I couldn’t tell them what I was doing in lab, and like they just couldn’t understand, and it is a huge divide.

Subsequently, Alma also adds that the debate about animal experimentation, particularly the side of opposition, is offensive to professors. When I asked Alma if this debate was ever mentioned in lectures or labs, she explained, “Yes absolutely. Like every prof will mention it, because it’s offensive of course to professors. People basically calling them villains because they’re using animals.” This suggests that the pedagogy that students are experiencing is one sided, with no mention of the arguments or critiques of animal experimentation from those within the scientific community. Therefore, students’ education seems to mislead them by omitting the arguments of scientific opposition, leading students to homogenize the perspectives of those within the scientific community towards animal experimentation in favour of this practice.

Furthermore, this assumption is problematic because it positions only those who are not directly involved in animal experimentation as the opposition, which makes it easier to discredit their views and position their voices as ignorant outsiders in this discussion. Due to these perceptions, students such as Devin, Noah and Alma, are able to contend that “science people”, as Devin puts it, understand that animal experimentation is acceptable and necessary, whereas those outside of the sciences who oppose animal experimentation are simply misinformed. Alma

in particular felt strongly that the opposition to animal experimentation is coming from those who are uneducated on the practice, explaining that

> There is a difference between like the people who are more attracted to a scientific program, like you do learn right away of course animals are used all throughout science, so you get accustomed to that sooner. But there's a huge divide at Brock… I would say that most people who are very against it are also not very well educated in what happens at Brock.

Therefore, despite the fact that students appear unaware of the internal debate on animal experimentation, particularly the opposition from scientists and researchers within the scientific community, some students assert that it is the opposition who are not well educated on this practice. Additionally, Alma adds that in response to confronting the debate professors have told student "just don't engage" with those who oppose it, which creates a further divide between the proponents and opponents of animal experimentation by deterring dialogue and debate. Furthermore, this insinuates that those who oppose animal experimentation are simply too far removed from, and unable to comprehend, the scientific rationale, therefore there is no point in discussing this practice with the opposition. Not only is this problematic because it ignores the countless scientists and researchers with extensive scientific knowledge who oppose animal experimentation, but it also dissuades students from engaging in conversations on the controversy of animal experimentation. Subsequently, this mentality of ignoring opposition to a controversial practice diminishes transparency, which makes it increasingly difficult to challenge and promote change through constructive dialogue.

Gender Differences

In Chapter Two, I examined the literature on how women and men differently view the practice of animal experimentation. Many past studies have suggested that women are typically

more against animal experimentation than men (e.g. Birke et al., 2007; De Villiers, 2012; Fancovicova et al., 2013; Oakley, 2013; Ozen and Ozen, 2010; Pedersen, 2002). In *Brutal: Manhood and the Exploitation of Animals*, Luke (2007) asserts that historically animal experimenters typify manhood, while the opposition to animal experimentation is associated with femininity and traits such as emotionality and illogical thinking. Experimenters viewed animal experimentation as a dominion over nature, and since the capacity to dominate was seen as a male trait, the performance of animal experimentation was a way of achieving manhood (Luke, 2007). Luke (2007) explains that the construction of animal experimentation as 'men's work' is rooted in a history of sexism in the sciences. Thus as Pedersen (2002) suggests, this difference could be due to gender stereotypical behaviour.

However, despite the research that suggests a gendered difference in perceptions of animal experimentation, five out of six participants outright rejected this notion. Aubrey, Devin, Noah, Layla and Alma all explain that they have not found any difference in their education between how men and women respond to animal experimentation. It is important to note that past research often explored gender by examining women and men's perspectives on animal experimentation, rather than asking them if they believe there to be a difference in how men and women respond to this practice. This could potentially account for some of the discrepancy between my findings and the findings of previous research, and one might question if students are accurately able to see gender operating in their experiences. Alma asserts, "I've had a lot of male partners and it's never been like 'oh I'm macho, I'm doing the dissection.'" She also explains that in a recent lab, in which students were dissecting clams, her partner for the dissection was a man and he asked her to do the dissection because he did not want to. Furthermore, Devin also notes that in her opinion there is not a gender difference of how men

and women feel about animal experimentation, and that there are more women in her program than men. Conversely, Rowan believes that there is a gender difference, stating, "Yeah, in health science class. Like I guess I know more females that would be against it, yeah."

While all of the women interviewed assert that there is no gender difference in perceptions of animal experimentation, it is possible that women may feel the need to perform a non-emotional guise, in the process of legitimizing themselves in a typically male dominated field. With the existing stereotype of animal experimentation, and the sciences in general, to be seen as masculine, and the opposition to animal use as feminine (Luke, 2007), it is possible that women are under even more pressure to disassociate from any emotion in the sciences, given these stereotypes. This distancing from emotional response could be used in an attempt to be viewed as more "professional" and "scientific", in fields of science where emotion is viewed as unscientific and illogical (e.g. Luke, 2007). However, men may also potentially feel the need to perform a non-emotional guise, in order to uphold their masculinity, as well as to appear more scientific and professional.

In regards to Rowan's contention that there is a difference of perspective between men and women, it is possible that this opinion is related to his year of study. While the majority of the participants are in their senior years of study in their undergraduate programs (Layla – third year; Aubrey, Devin and Noah – fourth year; Alma – fifth year), Rowan is in his second year of biological sciences. This difference in year of study, in relation to one's perception of gender differences towards animal experimentation, could suggest that students in junior years are more open about their opposition to this practice. Therefore, perhaps in Rowan's experience as a second year student, there is more opposition among students who do not have as much experience with animal experimentation, and among this opposition there are more women than

men. Whereas conversely, students from more senior years of study are more accustomed to this practice, equating to less opposition in general regardless of gender. As Pedersen (2010) explains, there is a desocialization process in pedagogy about animal use, in which emotional responses to animals are tapered into more "professional" outlooks on animal use. Pedersen (2010) defines the term desocialization as "'a critical rethinking of existing socialization' (117) in the form of an educational counterculture or a form of *unlearning* previously received knowledge" (p. 33). In the socialization process of pedagogy on animal use, Pedersen (2010) argues that a desocialization process also occurs in which students unlearn previous meanings of animals. Therefore, applying this theory, I argue that students in later years of study, who are further along in this desocialization process, likely exhibit less resistance against and distaste towards animal experimentation. While students in Rowan's classes, who are just beginning to do animal experimentation, and have not had as much experience in the desocialization process, are more likely to oppose it. Thus, it appears that within this sample, gendered differences may be dependent on the student's year of study; particularly that it is more prominent in earlier years, and less apparent as students advance through the desocialization process.

Ethical Ambiguities

During the course of the interviews, ambiguities were apparent through phrases such as, "ethical treatment" and "respect" for the animals. These words were used to describe how we should treat animals in labs, and further reinforced many students' arguments as to why animal experimentation is justified. Aubrey, Devin, Noah, Layla, Rowan and Alma, all mentioned the words "ethical" and/or "respect" throughout their interviews. However, very few concrete details

were provided as to what these words meant in the context of animal experimentation in their education, and when participants described them, their meanings varied.

The concept of ethics is rather ambiguous, and it appears to be used by instructors largely to reassure students that the practices they are doing, involving animals, are acceptable. The indefiniteness of this concept produces a vagueness that was apparent in many accounts of participant perceptions of the acceptability of animal experimentation. For instance, Aubrey explains that "if the ethics are in line, then it's fine", Noah asserts his support for this practice "as long as we are being ethical", and Layla contends that from what she was told "they're (the animals) treated pretty ethically." Devin, Rowan and Alma also made similar statements. It seemed as though many students were simply inserting 'ethical' into conversation to defend the practice of animal experimentation. Furthermore, Devin equates ethical treatment with Brock following the "guide-lines", and Alma relates ethics to the experiments being performed in a professional manner. Additionally, some students equated ethical treatment with proper care from animal technicians, not harming the animal "too much" (Rowan), and only killing them when it is "necessary" (Layla). In all of these accounts, as I asked students to explain what they were taught about ethics, they continued to use ambiguous language and statements in their attempts to substantiate ethics. For example, in Layla's discussion of ethics she explains,

> As long as the animals aren't hurt then its ethical, but it depends on if they're being killed at the end and why. So like if they're being killed at the end and they didn't do anything bad [to the animals] then I don't know. Like if they didn't open their brain or whatever… after that then they have to kill them, but if it was just [that] they injected them with a hormone and then they killed them, I don't think that's ethical at all.

In Layla's account, she begins by explaining that a practice is ethical "as long as the animals aren't hurt", however the concept of being 'hurt' is ambiguous, as well as whether or not they did anything 'bad' to the animals. Furthermore, Layla subsequently contradicts this when she

implies that it is ethical to kill an animal if the experiment involves opening the animal's brain, despite the fact that this would undeniably hurt the animal.

Another example, highlighting the variance between students' perceptions of ethical treatment, is when Alma explains that there is a lot of misinformation from people outside of the sciences at Brock who think "once were done with the rats we just chop their heads off and throw them in the garbage, but you're not allowed to do any sort of surgery unless they're anesthetized… its all done very professionally." Alma denies that animals are decapitated and insists that animals are ethically euthanized. However, conversely, Devin asserts, " I know that in the lab I'm in, they decapitate them (rats), and that's… they think it's the quickest way and most humane way to end it." While Alma insists that unethical decapitations do not happen at Brock, Devin asserts that decapitation is used in her lab as the most humane way of killing the rats, according to the animal caretaker. Therefore, the variance and vagueness of what is considered "ethical" suggests that it is likely used in pedagogy to describe animal experimentation practices in order to reassure students of the acceptability of this practice.

In addition to the ambiguous use of what is ethical, five out of six students deferred to the concept of "respect" to emphasize how they are taught to treat the animals. Noah explains, "we have been taught that we should treat the animals with respect"; Aubrey, Devin, Layla and Alma also made similar statements about treating the animals with respect. Once again, the term "respect" is highly ambiguous, and when students expand on what this means in practice, various responses were given. Alma explains that students are "always taught to treat them (animals) with the utmost respect… like you would never tap on the glass to get their attention, or you always want to make sure they're in the least amount of pain." While Layla explains that she was taught to "treat them with respect, but not [to] like play with them because it could mess up the

experiment, just kind of treat them like a patient." Treating the animals with "respect" also translated to not seeing them as disposable items (Aubrey), not taking photos of them (Noah), being prepared for the experiments and learning the physiology of the animal (Alma). Therefore, how students are defining "respect" was subjective to each participant, but each student purported that respect is taught and applied in the treatment of animals at Brock.

The above two examples illustrate a use of concepts, with perceived positive connotations, that are applied to animal experimentation to foster acceptability and justification of this practice. While students assert that animal experimentation is done "ethically" and with "respect" to the animals at Brock, I question whether either of these things are even possible within this practice. Is it really possible for animals to be treated "ethically" and with "respect", when they are objectified, physically and/or mentally harmed through experiments, and ultimately killed? I assert that this is not possible, and that the above-mentioned attempts to legitimize animal experimentation through supposed ethical and respectful treatment are unconvincing. Even if certain measures are taken to improve animal conditions or lessen pain, it still does not excuse the underlying fact that animals are physically and/or mentally harmed, and subsequently killed. The animals did not choose to be part of these experiments; therefore it becomes implausible to assert that they are treated ethically and with respect under these circumstances, as they did not consent.

Furthermore, on two occasions Layla says that her knowledge of ethical treatment came from being *told* that the animals are treated ethically. Layla explains, "for the most part, from what I was told, they're treated pretty ethically", later noting more specifically "the rats, I was told, are treated very well." This suggests that students may believe animal experimentation is ethical because that is what they are taught to believe. Therefore, when instructors teach students

about ethical and respectful treatment of animals, it becomes a rationale for the use of animals and an absolution strategy to displace feelings of guilt. Birke et al. (2007) assert that students learn a form of absolution, which allows them to deny responsibility when using animals. Building on this, I propose that students also use the ambiguous assumptions of "ethical" treatment and "respect" as forms of absolution of guilt and responsibility from their involvement in animal experimentation and the animals' subsequent death.

Absolution of Culpability

In relation to the concept of absolution from Birke et al. (2007), several students in various ways illustrate the theme of absolving culpability, as outlined by Arluke and Hafferty in the article, "From Apprehension to Fascination with "Dog Lab": The Use of Absolutions by Medical Students" (1996). According to Arluke and Hafferty (1996), the process of absolution, for students engaged in animal experimentation, is done through a denial of wrongfulness and responsibility in the experiments and deaths of animals. In the interviews with Aubrey and Layla, they use absolutions to portray animal experimentation in a consensual and positive light for the animals. Aubrey praises that the animals "are dedicating their lives to science", suggesting that animals are willing and consensual participants in their own deaths, thus absolving herself from any ill consequences. Conversely, Layla explains how a professor told her that some of the animals

> Get to be experimented in many different experiments, and then some of them aren't because of their life expectancy… they don't just kill them because they were in an experiment, it's mostly because of their life expectancy, so there is that. That kind of helps me a lot.

This portrays animal experimentation as a privilege for the animals, in which some *get* to be used multiple times before they are killed. Furthermore, Layla is absolving herself by displacing the

blame of their death onto an undefined “they”, and denying wrongfulness because she claims they are only killed if their life expectancy is lowered by the experiment that they were subjected to. Consequently, Aubrey and Layla use absolutions to put a positive spin on the practice of animal experimentation, and to create acceptability in their engagement with animal models.

In four of the six student interviews, a crucial aspect for their acceptability of the practices that they engaged in was the assumption that animals were not in pain during the procedures. This relates to another absolution strategy identified by Arluke and Hafferty (1996), in which students establish absolution based on the principle that if animals are anesthetized and do not appear to feel pain, then whatever transpires during the experiment is acceptable. Aubrey highlights that once an animal is anesthetized “they won’t experience any pain”, which therefore “mitigates any harm to [the animals].” Conversely, even when the animals are not anesthetized, students still use this absolution technique. Layla notes that “most of the time they don’t feel the pain”, explaining that before an animal is injected with something “they whirl the tail around” and “they’re just stunned so they don’t really feel it, so that helps too that they weren’t in pain.” In another example, Alma and Devin, both highlight their experiences using crayfish. Alma asserts that research has proven that “they don’t feel pain”, while Devin claims that since they’re kept in ice prior to the experiment, the cold anesthetizes them so “they don’t need anything” before they are decapitated. Therefore, the uneasiness of harming animals is mitigated once they believe the animal is not in pain, which appears to be used by Aubrey, Layla, Devin and Alma to absolve them from responsibility and any wrongdoing.

Additionally, students also draw attention to the perception that animals have a better life in the lab than they would in the wild. This mentality could also be a form of absolution, in which students deny culpability and wrongdoing in animal experimentation, because they

supposedly would still have a better life in the lab than they would otherwise. Aubrey explains that the animals are treated well, continuing with "I won't say as close to what they experience in the wild, because that's not necessarily representative of a good life for an animal." Similarly Noah feels that the animals might have a better life in the lab than in their natural habitat, because "they're fed, they're taken care of." Alma also adds, "they live longer when they're research animals in general than they would out in the wild." These assertions suggest that the freedom of animals, from captivity, harm and death, do not measure up to the quality of life that animals experience in labs. The absurdities of these claims reveal them to be a means of absolution, as Aubrey, Noah and Alma portray the captivity of lab animals as beneficial for them. In actuality, this perception is likely another attempt to create a sense of acceptability towards this practice.

Arluke and Hafferty (1996) expand on their discussion of absolutions to include that—in addition to them being used to remove stigma and permit a moral acceptability of questionable practices—absolutions also "morally elevate the behavior, making it an honor or privilege to perform while leaving one's moral self completely unscathed if not somewhat enhanced" (p. 222). This element of absolutions is clearly identifiable within the interviews, as three of the participants noted that it was a great privilege to perform animal experimentation in their education. Aubrey explains, "it is a privilege not a right to work with animals" and that "we're taught that not every school has that opportunity, and to be cognizant that we are very privileged to have them." Layla and Alma express similar feelings, as Layla notes, "Brock is one of the schools that does that, so it's a privilege to be able to do that." As Aubrey, Layla and Alma relate their experience of using animal experimentation in education to a "privilege", they also perceive that students at other schools do not get the same opportunity to use animals in their education.

Alma explains that her friends at other larger universities have not had the same opportunity to use animals, because "they can't get approved by ethics for their classes of a thousand because of course they're not going to use that many animals, but like my labs, there's ten of us." While Alma perceives the reason to be an issue of class size, Layla understands their privilege of using animals to be a result of the instructors having a lot of trust in their students. She states, "I guess they trust us enough… or [we] are qualified enough to work with the rats and not like waste the rat." Thus, students are taught that animal experimentation is a privilege that other students are not always fortunate enough to have, which instills the perception of animal use as an honour that is granted to them. Absolutions are formed to shield any stigma associated with animal experimentation and prompt moral acceptance through the perception of "privilege", thus allowing students to deny any wrongfulness and responsibility in their educational use of animals.

Lives of Luxury

While students exhibited support for the continuation of animal experimentation in education and research more broadly, their justifications for this practice varied in responses. However, a particularly interesting commonality was the assertion that a certain aspect of an animal's life was one of luxury. Four noteworthy examples of how students related animal lives in the lab to lives of 'luxury' are emergent from the interviews, discussed below.

In the interview with Aubrey, she explains that animals are not 'sacrificed' at the end of an experiment, rather they enter into a retirement, whereby "they're just allowed to live until the natural course." In this example, Aubrey is responding to criticisms of animals being killed by suggesting that once their 'job' is over in the lab, they are allowed to retire peacefully. Aubrey

claims, “after… whatever they need to be used for has happened, they will then go into retirement and they will basically live out the rest of their days.” By using the term ‘retirement’ to describe an animal’s ending in the lab, Aubrey is obscuring the deaths of lab animals. Despite the fact that other students refute the idea of a retirement for the majority of lab animals used at Brock (Devin and Alma), Aubrey used this concept to justify the process of animal experimentation by suggesting a silver lining at the end of this practice.

Similarly, Devin and Alma both depict examples of preferential treatment of animals compared to humans. As Devin explains, “they [instructors] always tell us that the air that they [animals] breathe is cleaner than ours.” This notion depicts animals as having a superior luxury to humans, which according to Devin signifies their high quality of life and care. Furthermore, Alma illustrates a professor’s account of past research on cats, in which researchers would feed the cats their own lunch, if their cat food did not arrive on time. Alma explains that her understanding of how research animals are treated comes from

> what profs have said. Like one of our profs was talking about when we still did research on cats instead of rats, and like if the cat food didn’t come in, they would feed them their lunch and the researchers would go hungry for the day.

This example suggests a form of sacrifice on the part of the researcher in order to make the animals they are experimenting on more comfortable. This depiction, as described by a professor, suggests that despite the fact that experiments are performed on these animals (exact details of the cat experiments were not provided), the researchers are putting the animals’ needs above their own. In reference to the context of both Devin and Alma’s comments, both used these professors accounts as anecdotal evidence that animals are given outstanding care, thus justifying the experimental procedures they endure.

Additionally, in the interview with Layla, she mentions that while she was ambivalent about the practice of animal experimentation being a part of her education, she found solace after speaking with a professor regarding the animals' care and transportation to labs. Layla states that

> If they [animals] were treated really badly, I would be completely against it. But since… [the professor has] shown me that they get the top of the line treatment, like they're flown in, they get their own plane, they drove in limos and stuff. Like I feel like that kind of reassured me.

In this example, Layla is equating the luxuries of private planes and riding in limos with "top of the line treatment" for the animals in the lab. In this case, if this was indeed true, these are 'luxuries' on a human standard, which likely has no luxurious meaning for the animals themselves. Furthermore, it is difficult to assert that animals who are kept in crates and cages during transportation, and who have no concept of anthropocentric methods of transport, would have any understanding of a private plane or limo signifying a privileged standpoint. However, nonetheless this assertion made by one of Layla's professors has worked at making her feel more comfortable, and making the process of animal experimentation more palatable. In all of the above-mentioned accounts, the comments made by students regarding the perceived luxurious aspects of a lab animal's life, is conveyed from their instructors to them in various contexts.

Therefore, seemingly, instructors are using these discourses to influence students' perceptions of animal experimentation as an acceptable practice, by exaggerating and falsifying certain aspects of animal lives to give a false representation of luxury associated with their life in the lab. Seemingly, all of this is done to negate students' guilt and concerns about using animals in painful physical and mental experiments, thus appeasing them with the perception of animals' luxurious treatment and exceptional care while in the lab. However, these perceptions are constructed despite the fact that students typically do not see how animals are housed and cared

for, outside of the experiments, with the exception of those who do a fourth year thesis, like Devin, or do some kind of volunteer work or research assistantship in a lab, like Alma.

Objectifying and Obscuring Language

Throughout the interviews, the language that students were using both objectified animals and obscured the process of animal experimentation. The ways in which animals were objectified through language often took the form of referring to animals as "it" or "thing". One illustration of this is Layla's discussion of the difference between using computer models and animal models, in which she says that in animal experimentation "there's actually a little thing on the table." Furthermore, Rowan continued to assert that there is "no need to harm it", above and beyond what is expected as part of the experiment. In these examples, it becomes apparent that the transition from 'naturalistic animal' to analytic object has been made (Lynch, 1988), and lab animals are subsequently viewed as objects in the lab to make the process of using them more acceptable and palatable. Devin explains, "we're kind of taught not to think of them as like animals kind of thing. Like you kind of just think of them as a study or a project." Therefore, the meaning of a lab animal is constructed and taught in an objectifying way, which reinforces the acceptability of their use. This subsequently positions the lab animals not as selves, but as bodies (Pedersen, 2010), which constructs them as bodies for human use (e.g. Arluke, 1988; Lynch, 1988; Pedersen, 2010; Peggs, 2015).

Additionally, students also engaged in obscuring language and euphemisms to obfuscate certain aspects of animal experimentation, most notably their deaths. As students were asked about the life course of the animals in the lab, Noah, Alma and Devin used obscuring language to explain their deaths. Noah states, "Brock will discard of these animals", while Alma uses

"terminated" to describe the process of killing the animals. Furthermore, when Alma explains an experience where she had to kill a crayfish before dissecting the animal, she says that students "had to *take care of that*, and then dissect them." Similarly, Devin uses the word "dispose" to explain the deaths of the lab animals, and says that in her experience they typically "dispose" of them by way of "decapitation". Devin explains that "they also can give them like some kind of drug I know, but the animal care taker that's down there doesn't agree with that way, because there's still more suffering than there would be if they decapitate them (rats)." Interestingly, Devin felt the need to obscure the word 'kill' with the more palatable word 'dispose' or simply allude to their killing through "decapitation". The obscuring language surrounding discussions of animal death with students could suggest that it is a learned behaviour from the language used by instructors and course readings. As Birke and Smith (1995) explain, in many published papers euphemisms are used to minimize the death of the animals, in part by avoiding the word "kill" and replacing it with "sacrifice", "harvest" or "decapitation". Similarly, students' use of words like "discard", "terminate" or "dispose" act in the same way, to minimize the significance of death through the avoidance of the word "kill". Therefore, the bluntness and significance of the word "kill" is often replaced with more obscuring language.

Marginalization of Alternatives

As I began to discuss alternatives to animal experimentation with participants, I realized that the success stories of alternative methods in previous literature were very different from the Brock students' perceptions of alternatives. As some studies have noted (e.g. Pedersen, 2002; Wang, 2001), students using alternatives to animal experimentation in education performed equal to, if not better than, students using animal experiments. In a study with seventy-five

pharmacology students, Wang (2001) asserts that students found it much easier to understand concepts and learning objectives with the computer-simulated experiments. Researchers also assert that there is a general preference by students towards alternatives over animal experimentation (DeHoff et al., 2011; Wang, 2001). However, participants' perceptions of alternatives were bleak, and the general sentiment was that they are not as good as animal models. One potential explanation of the negative perceptions of alternatives could be due to the fact that alternatives are often marginalized in education, and not often advertised and/or portrayed in positive ways by instructors. Below I highlight students' accounts relating to the availability of alternatives, the ways that alternatives are presented to students, and the perception of alternatives as inferior to animal models.

When I asked students were if alternatives were offered, if they did not want to participate in animal experimentation, the responses were mixed. Aubrey claims that they were taught at the beginning of her courses that there are alternative methods available; in contrast, Noah explains that he has never heard of any alternatives to animal experimentation being offered in his classes. Other students, such as Devin and Alma, explain that the availability of alternatives is dependent on the course and the experiment. As Devin states, in one of her classes an alternative was offered for an experiment on a sheep brain; yet, no alternative was offered for a subsequent experiment on crayfish in the same course. Additionally Alma notes, "in some classes it's not made available, like we're told like this is a lab-based course and there's no alternative. Like, if you don't feel comfortable don't take this class; you should drop this class." In both Devin and Alma's accounts, it becomes apparent that students are not always given a choice to opt out of experiments; rather students are expected to participate or drop out of the

selected course. Therefore, it is evident that the availability of alternatives to animal experimentation can vary based on the instructor, the course, and the experiment at hand.

Additionally, students also mentioned the fact that alternatives are not very well advertised. As Rowan states, "They're there, but they haven't really given us a 'if you don't want to do the dissection, you can do this'. They haven't like come up front with that." Additionally, Alma concurs that she thinks professors would accommodate requests for some alternatives, "but it wasn't advertised." Therefore, these examples highlight the marginalization of alternatives, because even when the options are available, professors do not explicitly present that option to students or detail what an alternative would entail. This is further indicated by Noah's confusion about whether or not alternatives were available, which either means that there was no alternative or if there was, it was not clearly presented to students. Subsequently, Devin explains that even when her class was formally presented with information of an alternative online module, for students who did not want to participate in an animal experiment, the professors added that students who choose the alternative would not get as much out of it. Thus, according to Devin, her professor "put a negative spin on doing that." This suggests that the de-legitimization of alternatives to animal experimentation is present in overt teaching of alternatives as a replacement to animal use, as well as the hidden curriculum of science students at Brock when they are not explicitly advertised.

When instructors delegitimize alternatives to animal experimentation, students are being taught that alternatives are not as useful as animal models, and (through a hidden curriculum) that animal experimentation is the best option. Under this hidden curriculum students are tacitly influenced to believe that animal models are necessary because alternative methods, according to certain instructors, are ineffective. Moreover, by not advertising alternatives, or by presenting

them in a negative way, instructors are likely discouraging students from coming forward, regarding their reservations of animal experimentation and their potential interest in alternative methods. Furthermore, even when students do come forward regarding their concerns with animal experimentation, alternatives are still marginalized for students. Layla highlights this, as she reflects on an experience she had with a professor regarding her discomfort with animal experimentation. She explains that when she went to talk to her professor about this, he tried to persuade her into doing the experiment anyways, by talking about how ethical the experiments are at Brock and how well the animals are treated. Layla does admit that at the end of their discussion he told her that an alternative could be arranged "as a last resort", but the conversation was more so focused on trying to convince her to engage in animal experimentation. Layla states, "He more so focused on that [how animal experimentation is ethical] because I think he really wanted me to participate in the lab, but as a last resort he was like, 'if you really don't feel comfortable you can do this [an alternative, such as writing a paper].'" Ultimately Layla expresses that "he also did stress that it would not…it's not as beneficial as actually participating in the lab, because it's hands on", which made her reevaluate her stance and choose to participate despite her initial discomfort. It appears that professors clearly favour the use of animal experimentation, and in some instances even go as far as dissuading students from opting out of animal experiments. In the case of Layla, her choice to ultimately participate in the experiment is reminiscent of the argument made by Birke et al. (2007), that while students may be faced with moral dilemmas regarding the use of animals, they are often unable to resist authority figures, such as professors. This argument is similarly composed by Pedersen (2010), which shows how influential instructors are in shaping the attitudes, perceptions and, in some cases, actions of students.

The overall perception, most notably expressed by Alma, Devin, and Noah, seemed to be that alternatives were not as good as using live animals. Devin recalls a time when a vegan student, who was uncomfortable with animal experimentation, tried an alternative, explaining "she didn't feel like she got anything out of it [the alternative model]… like she thought she could just get away with doing a computer module and get as much out of it as she did, but then again she wasn't doing anything so that makes sense." In this example Devin equates an alternative model to 'doing nothing', which suggests a perceived lack of legitimacy in alternatives to animal experimentation. Also, when Devin says, "she thought she could get away with doing a computer module", it further suggests that she views computer modules as delinquent shortcuts for lazy students. As previously mentioned, Devin also later explains that while her professor did inform them about an alternative online module, she told the students that they would not get as much out of it, which "put a negative spin on doing that." Therefore, Devin's perception of alternatives, as not really doing anything, is likely influenced by how that information was presented to her by her professor.

While none of the participants had ever refused to take part in an experiment, prompting the requirement of an alternative to animal models, a few students had experience using alternatives in addition to live experiments. Alma notes that some courses will use alternatives as a precursor to the animal experiments, rather than a replacement. Based on Alma's reflection of her experience using an alternative, she states

> In my genetics class, we use them for like one of the fruit fly labs, and I'm not going to lie it was really horrible. It was literally like I'm clicking this screen, I have no idea what's happening, and it's like "and now you made 1600 fruit flies"… So they just seem in my experience like really outdated. I'm not sure if that's because they are making better ones and it just costs money.

In this example Alma is referring to a computer simulation that she participated in, and expresses her frustration in the outdated technology. This suggests that up to date alternative methods are not being offered to students, thus further influencing their negative perceptions of alternatives to animal experimentation. Subsequently, students also expressed the perception of alternatives as not being good enough to replace animal experimentation, at this point in time. Noah, Alma and Rowan explain that while they would be open to alternatives to animal experimentation, the alternatives are not there yet and "it would take more time and research to develop them" (Rowan). This suggests that despite there being high-tech alternatives available, the alternatives offered at Brock, coupled with teacher representations of alternatives, have made students wary about their legitimacy and capacity to adequately replace animal experimentation.

Influences of Pedagogy on Student Perspectives and Experiences of Animal Experimentation

Understanding students' experiences of animal experimentation and its teaching is extremely important in analyzing how perceptions and experiences are shaped. As highlighted in the thematic analysis, students have strong perspectives on animal experimentation and its uses in education and beyond. Such perspectives have been developed through their pedagogical exposure, with many students using their learning to explain their acceptance and support of animal experimentation. While students' experiences are surely noteworthy in the analysis of their learning, interpreting how these experiences influence students' perspectives is also of great significance in understanding the reproduction of animal experimentation as the status quo. Interestingly, Rowan notes "we've been taught that they've always just done it on animals." This illustrates how normalized animal experimentation is in the sciences. My intention is to understand how and what influences students' normalization of animal experimentation as a

status quo practice in science. Thus, as all participants believed animal experimentation to be a necessary part of their education, I began to inquire about how and what aspects of their education were most influential to their perceptions. Largely students expressed similar influences, with all six indicating that their instructors were highly influential in shaping their perceptions and understandings of animal experimentation. As previously suggested in the thematic analysis, the pedagogy that is taught to students and the ways that it is presented to them by their instructors has a significant impact on their perceptions and experiences of animal experimentation in their education. Here I discuss the influences of instructors and pedagogy expressed by students in their interviews.

In every interview, students highlight ways that pedagogy, and more specifically their instructors, are highly influential in shaping their thoughts and perspectives on animal experimentation and animal ethics. Noah outright asserts that professors are the most influential in shaping students attitudes towards animal experimentation, because they are constantly drawing on previous animal research in lecture. Noah explains, "when [the professors] are lecturing in a lecture, they are referring back to [animal] research that has been previously done." Furthermore, Noah continues by noting, "I haven't had a professor really talk about any research that has been done on animals, that has turned into a clinical trial afterwards, so it is mostly just animal experimentation that they do talk about in lectures." Therefore, the focus of Noah's learning in the biological sciences program has been on animal experimentation, with little to no information on human-centered clinical trials that would be directly applicable to us.

Similarly, Layla feels that talking to her professors about it and the way that they "explained it and the ethics behind it" influenced her views. Additionally, both Aubrey and Alma add that professors are very open and informative when discussing the importance of animal

experimentation to education and research. Alma further asserts, "in my cohort of science students, everyone is on the exact same page. Obviously someone along the way is doing a good job of educating us." In these accounts, students highlight the role that professors play in shaping student perceptions of animal experimentation, and the normalization of this practice as necessary and important.

While some comments from students appeared uncritical of the pedagogical influences in their perceptions of animal experimentation, others were very much cognizant of how their perceptions are actively shaped by their instructors' perceptions. As Devin reveals

> We just assume "oh it's just a school, like this is to learn, everything must be fine then", kind of thing, you know? And then the profs, obviously if it's in their class and you're doing experiments on these things, they vouch for it. So their views are positive, which makes your views positive.

Subsequently, Devin also notes that unlike the Sociology students, who learn about the negative side of animal use and experimentation, in sciences classes "they only touch on the good stuff." Therefore, Devin acknowledges that her experience of pedagogy only focuses on the positive aspects of animal experimentation, which then shapes students' perceptions of this practice as positive. Additionally, Noah and Alma highlight the vested interests of professors in valuing animal models, because of their own research being based on animal models. Noah asserts that professors surely value the animals and practice "just because it does play a major role in their research." While Alma explains that "it's their career, so they're not going to want to say, 'oh they're treated really poorly,' because they don't want to feel like villains." Thus, students are aware of the potential motives behind their professors' support of animal experimentation in education and beyond. Moreover, when Alma is explicitly asked what influences her perceptions of animal experimentation she asserts, "definitely my professors. Like I won't lie, they do bias us, but not in a bad way I think." This statement, along with similar expressions from other

students, suggests that even though students are aware that instructors influence their perceptions, with pedagogy that only represents positive aspects of animal experimentation, they are largely unbothered by this. While students did exhibit critical perspectives on how their perceptions are influenced by pedagogy and professors, they do not confront this issue or look beyond their experiences of pedagogy to challenge this, and they continue to assert the importance and necessity of animal experimentation. Therefore, some students acknowledge the pedagogical bias, and critique its one-sidedness on the issue of animal experimentation, but do not deviate from it in any significant way, thus maintaining the status quo.

While all students interviewed expressed the necessity of animal experimentation, Layla, Alma and Rowan also expressed initial hesitation and difficulty engaging in animal experimentation. Furthermore, they also highlight how instructors were influential in convincing them to participate despite their discomfort with this practice. Alma explains animal experimentation as something she really struggled with initially, stating, "It's definitely not something that I relish in and that I don't care about, like it's something that does kind of affect me." Similarly, Layla describes animal experimentation as "gross" and "sad", and states, "I don't normally like looking at animals being dissected because I like animals." Moreover, Layla explains how it can be hard working with rats in her labs because her roommate has a pet rat. Layla notes how "horrified" her friend is when she tells her about various experiments that they do in labs, and reflects on how difficult it is when she thinks of her friend while working with rats in the lab. Additionally, Rowan has been a vegetarian his whole life and describes animal experimentation as "not really morally or ethically correct." He goes on to explain

> I'm a vegetarian, so like I don't eat meat. So for example, for me to cut an animal, it's like I don't know… something I have to do to learn about it, but it's something that personally I wouldn't really want to.

These examples depict the various struggles of students participating in animal experimentation, and suggest that not all students that engage in animal experimentation are comfortable with it.

Nonetheless, even though Alma, Layla and Rowan have trepidations about animal experimentation as a part of their education, they participate in it anyways. While they express a reluctance or hesitance to engage in animal experimentation, they are influenced by pedagogy and instructors to participate regardless. All three students explain that it is something to which you must acclimate. While Layla voiced her concerns to her professors, she was strongly encouraged to participate anyways, and now expresses that she is "kind of easing into it, so it's not as bad as it sounded before." Similarly, Rowan expresses that after conversations with teaching assistants he realizes that it is something that you *need* to get used to doing. While Alma states, "you learn right away of course animals are used all throughout science, so you get accustomed to that sooner." Therefore, the consensus seems to be that even if you do not want to participate in animal experiments, the pedagogy of animal experimentation instills a perceived necessity of this practice in students. This perceived necessity could be related to learning appropriate skills for a particular course, but as Alma and Rowan note, it is also necessary for future schooling and careers. Alma explains that instructors have expressed to her that for students that want to move forward in education and careers in the sciences, "a lot of it is animal based." While Rowan comments that "if you say that you don't want to do a dissection, that really limits your career opportunities." Therefore, students are influenced in various ways to participate and view animal experimentation as a necessary part of their education, and are socialized to accept this practice. Furthermore, even when students show initial discomfort in animal experimentation, their experiences of pedagogy and instructors influence and acculturate them into it.

Theoretical Reflection

Overall, this discussion of students' experiences of animal experimentation and how their experiences of pedagogy and instructors influence their perspectives of animal experimentation, exemplifies the theory presented by Pedersen (2010) and Birke et al. (2007), that students are swayed by figures of authority, and thus easily align with their instructors' positions. Using a critical pedagogy framework, I relate this influence to the Freirean theory of the banking concept of education. As Freire (2000) notes, education is often taught through the banking concept, in which students are treated as "containers" that need to be filled with knowledge. Freire (2000) problematizes this because it dissuades students from developing critical consciousness. For the most part students were uncritical of this practice, and at times appeared to be exhibiting the banking concept by simply regurgitating information taught to them by their instructors, using phrases such as "I was told" (Layla) or "we're taught that" (Aubrey) when asked about their own perceptions. Therefore, students are socialized to adhere to the perspectives of their authority figures, and are acculturated to accept the knowledge that is presented to them. This socialization and acculturation can even extend to make students feel that if they do not participate in animal experimentation then their education is somehow in jeopardy, either by not gaining the full knowledge and experience in labs or by limiting their career options. Furthermore, even when students questioned the moral and ethical implications of animal experimentation, they did not break away from the overall acceptance of this practice as a part of their education, as taught to them by their instructors, which exemplifies the strength of the influence that instructors and pedagogy has on students.

While I attempt to address and engage with student voice through the process of interviewing students on their perceptions and experiences of animal experimentation, it is

apparent that the standard pedagogy in their education marginalizes student voice. Through the banking concept, as discussed above, a stark power imbalance exists between instructors and students. Moreover, as Giroux (1983) explains, this unequal power relationship leads to an imbalance between teacher voice and student voice, through which students are taught to comply with instructors and the educational practices taught to them through domination. Therefore, student voice is marginalized and ignored, which substantiates Freire's (2000) connection between the banking concept and the passive role that is imposed on students, in which they are taught to accept the practices and principles taught to them. In my present research, students seemed to accept animal experimentation as a necessary part of their education and accept that it is ethical because their instructors told them so. When students did raise concerns to instructors, their voices were dismissed and it was again asserted to them that in order to advance in education and potential careers in research, animal experimentation is something that they *need* to do. Therefore, for some students, when they do voice opposition with an educational practice, their voice is managed and controlled through pedagogy, as discussed by Giroux (1986). Through these unequal power arrangements in the classroom, students are pedagogically manipulated into compliance to accept animal experimentation in their education.

Under this influence, through the power imbalance between teacher and student voice, the teacher is positioned as the 'subject' and the student is reduced to an 'object' (Freire, 2000). According to Freire (2000), the banking concept is premised on the understanding of students as objects, producing 'necrophily', which "transforms students into receiving objects" (p. 77). While some students mentioned instructors' willingness to discuss questions and concerns regarding animal experimentation, concerns were met with persuasion to participate in order to advance in the students' academic and professional careers. Therefore, through the

marginalization of student voice students are regarded as receiving objects of their instructor's pedagogy.

Aside from the direct influence of instructors on students' perspectives, the hidden curriculum in standard pedagogy also influences students' conceptualization of animals as research objects and the practice of animal experimentation. As previously mentioned through the thematic analysis, animal experimentation pedagogy has elements of the hidden curriculum built into it to tacitly reproduce and transmit the values and beliefs that are in the interest of dominant groups. Furthermore, as Taylor and Robinson (2009) assert, the hidden curriculum is used to reproduce the economic discourses of capitalism, and simultaneously produce compliant persons to work within the system. As Anderegg et al. (2002) establish, animal experimentation is a highly lucrative venture and often a central part of university budgets. Similarly, Almiron and Khazaal (2016) assert that while data on the exact amount of money invested in animal research at universities is unavailable, a large percentage of their budgets go towards applied science research, where animal experimentation is the norm. Therefore there are vested financial interests in maintaining animal experimentation in education, and reproducing a reliance on animal models. Similarly, in their analysis of the vivisection industrial complex (VIC), Almiron and Khazaal (2016) assert that academic institutions are a part of the VIC through sources of funding related to using animals in research. Universities and research labs, focusing on education and theoretical research, are the primary beneficiaries of public research and development funds globally (Almiron and Khazaal, 2016). While data relating to the exact amount of funding that is used in animal experimentation is unavailable, due to the lack of transparency in animal research, a large part of the research and development funds go to the hard sciences where animal experimentation is the norm (Almiron and Khazaal, 2016).

Similarly, Barbara Noske, author of *Beyond Boundaries: Humans and Animals* (1997), explains that the concealed nature of animal research makes it difficult to know data and figures on the exact experimental activities that take place in animal research facilities. Furthermore, in Noske's (1997) discussion of the animal industrial complex, she argues that academic institutions, as part of the animal research industry, have a vested interest in the continuation of animal experimentation. While people are lead to believe that animal experimentation is necessary for the benefit of human health and well-being, Noske (1997) asserts that the existence of this practice is for profit and career-making, as many medical discoveries have been achieved without animal experimentation, and the majority of this animal research is for curiosity and knowledge that has no direct link to human well-being. Additionally, in *About Canada: Animal Rights* (2010) author John Sorenson explains that the same is true in Canadian universities, in which animal experimentation means money. Sorenson (2010) illustrates that while the University of British Columbia, a supposed leader in biomedical research, was given lucrative funding to develop a new medical center, the director of that center, Dr. Chris Harvey-Clark, was unable to provide an example of any achieved successes at UBC through animal research. Despite the shortcomings and blatant failings of animal research, universities and professors are inextricably financially vested in the continuation of animal experimentation (Sorenson, 2010; Noske, 1997; Almiron and Khazaal, 2016), which the hidden curriculum in standard pedagogy helps to perpetuate. In order to reproduce the continued use of animals in research, the use of animals in education is needed to instill an acceptance and necessity of animal models into students. Therefore, when some students go on to do their own research, animal models are a normalized part of their procedure, and thus a continued part of the status quo in the scientific community.

A noteworthy example of this hidden curriculum is through the objectification process in animal experimentation pedagogy, in which students are tacitly taught to objectify animals in order to accept and conduct experiments on them. While the process of objectification in pedagogy more broadly can occur through the objectification of students, through the banking concept as previously mentioned, animals are objectified in pedagogy by both instructors and students. The transformation in the perception of animals from "naturalistic animal" to analytic object (Lynch, 1988), is a part of the hidden curriculum of animal experimentation pedagogy, to re-conceptualize animals as objects for human use. Furthermore, the objectification of animals in pedagogy is both a product and a perpetuation of a speciesist curriculum. As Pedersen (2004) explains, just as the hidden curriculum can convey messages of sexism and racism, it can also contain speciesist elements that impose animal objectification through curriculum. Speciesism is foundationally rooted in animal experimentation pedagogy, as students are taught to objectify animals, to regard their education above the lives of animals and to use them to enhance their knowledge. Indeed, the speciesist nature of their curriculum creates an additional power imbalance between humans and nonhuman animals. Just as the unequal power relations between teacher voice and student voice exist to marginalize and control the perceptions and voice of students, the human and nonhuman animal binary creates an imbalance that marginalizes the voice and subjectivity of animals.

It is important to note that just as student voice is existent but often marginalized and ignored in standard pedagogy, animal voice is also existent but ignored in animal experimentation. As Corman and Vandrovcová (2014) assert, it is important to highlight animal voice and subjectivity, so as not to reduce animals to a status of voiceless suffering beings. In the interviews, animal voice and subjectivity were not considered by students, or at least not

considered enough to warrant the inclusion of their position and voice in the conversation. While Layla seemed to occasionally acknowledge the subjectivity of animals, while relating rats in the lab to her roommate's pet rat, her considerations were overshadowed by her effort to fulfill her education. Even when asked to describe the life story of a lab animal, from their birth to their untimely deaths, students mostly avoided any indication of animals as subjects. However, the only time animals were mentioned subjectively was when students were discussing the perceived positive aspects of their lives, as discussed in the subsection "Lives of Luxury." This is suggested in Aubrey's account of animals' peaceful retirement, and Layla's discussion of lab animals travelling in private planes and limos. Furthermore, when students discussed the ethical and moral aspects of animal experimentation, there was no mention of animal voice or agency, with the exception of a brief mention that the animals are "dedicating their lives to science" (Aubrey), or any explicit consideration of how or what they might be feeling as the ones being experimented on. However, it can be argued that during students' mention of pain, more specifically mitigating animals' pain and discomfort during experiments, they are to some extent acknowledging them as subjects. While this is not an all-encompassing or deep consideration of animals' subjectivity, it is worth noting. Moreover, by ignoring animal voice and/or positioning them as voiceless in the conversation of animal experimentation, it further objectifies them through the notion that they "are acted upon – but never act" (Colling et al., 2014). This highlights the severity of anthropocentrism in their curriculum, as animal voice and subjectivity are not even a part of the conversation. As Devin explains, students are taught not to view the animals as animals, rather to view them as "a study or a project." Therefore, it is through this objectifying hidden curriculum that animal voice and subjectivity are concealed in order to make animal experimentation easier for students to enact. The concepts of animal voice and

subjectivity will be elaborated on in greater detail in Chapter Five, in a discussion of alternative methods.

In additional to the hidden curriculum of objectification, students are privy to a hidden curriculum of desensitization. Students such as Alma, Rowan and Layla, highlight the desensitization process, as they initially assert their emotional and ethical discomfort with animal experimentation, but then equate it to something that you get accustomed to as you ease into it. Furthermore, as Capaldo (2004) explains, a hidden curriculum of emotional neutrality associates emotional concealment with competency and professionalism in the scientific community. This aspect of the hidden curriculum could have influenced Alma, Rowan and Layla's eventual acceptance and disassociation from their original emotionally fueled concerns. Therefore, through the hidden curriculum of objectification and desensitization, students learn to see the animals "as a means to an end" (Birke, 2012, 14), thus accepting their use and compliantly working within the VIC.

In addition to students becoming acculturated to animal experimentation through a hidden curriculum, students were able to recount more directly how their instructors and experiences of pedagogy helped them to accept this practice as a part of their education. As Alma explains, "every prof will you know explain the importance of using animals in research, and why it's important, because they are trying to cultivate young scientists." Similarly Rowan and Noah also note that instructors are trying to build an acceptance of animal experimentation into students so that they can move forward in their fields and future careers. In this sense, students understand their current experiences of pedagogy and engagement in animal experimentation as being a precursor for their potential future work in research. Therefore, a

compelling justification to students for acceptance was based on the potential future repercussions of their opposition.

Conclusion

Throughout this chapter, I have highlighted the perspectives and experiences of six students at Brock University engaged in animal experimentation for educational purposes. In the analysis of various themes, I examined students' experiences of animal experimentation pedagogy and how their experiences of this pedagogy shape their views and beliefs on animal experimentation and animal ethics. Within the teaching of animal experimentation, instructors influence students through a speciesist pedagogy, and a hidden curriculum that tacitly shapes students' perceptions of animals as research objects and animal experimentation as an essential part of their education. Therefore, this current analysis affirms the findings of Birke et al. (2007) and Pedersen (2010), suggesting that students are easily swayed to align with educational authority figures (e.g. instructors). Furthermore, through these influences students become complicit in the reproduction of animal models as the status quo. In the following chapter I continue this discussion with a more substantial critique of animal experimentation for education, and an examination of alternative educational practices, moving forward with humane education pedagogy.

Chapter 5: Moving Forward with Alternative Methods

Despite the general debate and varying perspectives of students on alternatives to animal experimentation in education, in previous comparative work researchers have found that alternatives are equal, if not superior, to animal models for educational purposes (Patronek and Rauch, 2007; Pedersen, 2002; Wang, 2001). I will subsequently expand on this in the following subsection, while discussing some promising educational alternatives in greater detail. Thereafter I will continue with an examination of universities and programs that have implemented the replacement of animal models with alternatives. Finally, I will consider how to move forward using a humane education framework, and the importance of incorporating animal voices and subjectivities into this discussion.

As previously discussed in Chapter Four, students expressed a general apprehension associated with alternatives to animal experimentation. While some felt that there is merit in advancing and using alternatives in education, the overall consensus was that alternative methods are not up to par, and thus animal experimentation is still the best option at this time. As Dr. Lawrence A. Hansen, from the Departments of Pathology and Neuroscience from the University of California San Diego School of Medicine explains, students are indoctrinated in the myth that harming animals through experimentation is necessary (Hansen, 2014). This process can take shape through the hidden curriculum, as an instructor's choice to use either alternative or animal models, and how they discuss the models, can greatly impact how students view animal experimentation and alternatives (Pedersen, 2002). As Pedersen (2002) explains, students predominantly taught using alternatives often find them to be sufficient replacements for animal models, while students taught mainly with animal experimentation perceive animal models to be

necessary. Therefore, it is significant to highlight the influential role that pedagogy plays in education, particularly on student perspectives of animal models and alternatives, as it can greatly affect their views on controversial practices.

Outline of Alternatives

While many scholars, instructors and researchers use the 'Three Rs' principle to vaguely address consideration of refining, reducing and replacing animal experimentation, others argue that there is no need for three Rs because the focus should solely be on replacement (Jukes & Martinsen, 2008). Jukes and Martinsen (2008), using the work of Pedersen (2002) and Capaldo (2004 & 2005), argue that science education imposes a hidden curriculum on students, teaching them that harming and experimenting on animals is acceptable and instrumental, despite the numerous confirmations that replacement is feasible in education. These arguments work in accordance with my Chapter Four analysis and examination of how students' perceptions and experiences are influenced through this hidden curriculum in pedagogy. Furthermore, in line with Jukes and Martinsen's assertions, here I outline some noteworthy alternatives to animal experimentation that are available for educational purposes, specifically, computer simulations and models, student self-experimentation, in vitro and clinical work. While this is not an exhaustive list of alternatives to animal experimentation, I have chosen to highlight these because they were most mentioned in previous literature on alternatives for educational purposes (e.g. Jukes & Chiuia, 2006; Pedersen, 2002; John, 2013; Gruber & Dewhurst, 2002; Knight, 2011).

Computer Simulations and Models

The category of computer simulations and models broadly encompasses a variety of programs and technologies that are used to create virtual technologically based ways for students to visually and practically learn without animals. Computer simulations include virtual dissections and experiments, which can range from simple to highly sophisticated depending on the skill level and virtual procedure (Valliyate et al., 2012). Conversely, models and mannequins are used to simulate whole animals, internal organs or body parts, some of which are used for simply visualizing anatomical structures and functions, while others can be used in surgical hands-on procedures (Jukes & Chiuia, 2006). Pedersen (2002) also explains that some models are even made with artificial blood flowing through blood vessels and realistic outer skin, while computer simulations produce variability so that students can learn to interpret different results. The benefits of these computer simulations and models, as opposed to animal experiments, are that they allow students to examine multiple factors at once, receive immediate program generated feedback and assistance, and repeat simulations to master skills and concepts (e.g. Balcombe, 2000; Patronek & Rauch, 2007; Hansen, 2014; John, 2013). Both computer simulations and models are created for a wide range of educational practices and procedures, varying in depth and sophistication based on the learning objectives, and education and skill level of the students.

Student Self-Experimentation

While technological alternatives occasionally receive criticism due to its limitation with direct live organisms and living tissue (e.g. John, 2013), the following alternatives, beginning with student self-experimentation, address this. Student self-experimentation involves having

consenting students replace lab animals in non-invasive experiments (Jukes & Chiuia, 2006). As Jukes and Chiuia (2006), located in the United Kingdom, and Gruber and Dewhurst (2002), located in Switzerland and the United Kingdom, assert, many courses and programs in the health sciences use self-experimentation to give students practical experience with living bodies. These experiments could include analyzing blood samples, blood pressure, and urine samples before and after substance ingestion or mental and physical exercise (Jukes & Chiuia, 2006), examining cardiovascular functions and using non-invasive instruments such as surface electrodes (Gruber and Dewhurst, 2002), or pulmonary experiments using expelled air samples from students (Pedersen, 2002). As this alternative involves students as subjects, Jukes and Chiuia (2006) stress that ethics approval, student informed consent and the ability to withdraw at any time are essential for the safe use of this alternative. However, students engaging in this alternative tend to enjoy the active participation in student self-experiments (e.g. Gruber & Dewhurst, 2002), which can ultimately enhance their learning experiences.

In Vitro

In vitro experimentation can also address the limitations of computer simulations and models, as they involve the use of human, mammalian, bacterial, protozoal or yeast cell cultures for a range of testing procedures (e.g. Knight, 2011). Some of these procedures can include toxicity testing, carcinogenicity, and skin irritation and absorption (Knight, 2011). While this can be an ethical alternative to animal experimentation, it depends on how and where the cell cultures are sourced. Some of these in vitro tests involve the use of cells and tissue from animals, many of which are killed for this purpose (Sharpe, n.d.). Under these circumstances, this would not constitute an ethical alternative to animal experimentation because animals are still being

used and killed for their cells and tissue. However, as Dr. Robert Sharpe, Scientific Director of the International Association Against Painful Experiments on Animals (IAAPEA), argues, tissues and cells for these in vitro experiments can be obtained from healthy human volunteers during various therapeutic operations and biopsies, or through post-mortem autopsies. Not only would this save countless animal lives, but it would also provide more accurate and relevant findings for humans, as using human tissue is more reliable than animals (e.g. Sharpe, n.d.).

Similarly, Jukes and Chiuia (2006) explain that in vitro technology can be a viable ethical alternative, provided the cell cultures are ethically sourced. In addition to the use of voluntary human tissue and cells, Jukes and Chiuia (2006) highlight how plants can also provide material for in vitro testing. For example, mitochondria, which were traditionally sourced from rats' livers, can now be sourced from plant material such as potatoes, beets and turnips (Jukes and Chiuia, 2006). Jukes and Chiuia (2006) note that in vitro testing has the advantages of being cost efficient, faster than animal experimentation for assessing toxicity and more reliable and replicable, as well as the ethical advantage of not having to experiment on animals. Therefore, under ethical circumstances, in vitro procedures can save countless animal lives, and provide data that can teach and predict reactions in human systems at a more reliable rate.

Clinical Work

Clinical work has also proven to be a useful and beneficial alternative to animal experimentation, particularly among veterinary and medical students (e.g. Pedersen, 2002; Jukes and Chiuia, 2006). This alternative gives students a chance to gain experience working with real patients, which at the right educational level can amount to better training (Jukes and Chiuia, 2006). Under this approach, students in more junior and intermediate years of study would be

taught using other alternatives described above, while senior students who have mastered the necessary training and skills would advance to highly supervised work with real patients. Clinical work can involve apprenticeships, observational and demonstrative learning, and assisting senior professionals in their field (Pedersen, 2002). Furthermore, this approach provides students with experience and competence in realistic clinical environments (Gruber and Dewhurst, 2002). While clinical work is widely used in veterinary and medical education (Pedersen, 2002), its application should be expanded to eliminate the animal experimentation that often occurs prior to clinical work. As Pedersen (2002) and Balcombe (2000) note, students' roles and responsibilities under clinical work would expand from assisting to a more active role as their abilities and competency improves. Thus, clinical work could fully replace the technical experiences gained through animal experimentation, with observation and incremental assistance in professional environments. In veterinary school in particular, the use of animals in experimentation runs counter to the veterinary ethics of helping and caring for animals (Jukes & Chiuia, 2006). As an alternative, clinical work has the ability to change the narrative of hands-on experience, from harming healthy animals in lab settings to helping human and non-human animals in need of medical care. Therefore, this creates a mutually beneficial practice for students and patients.

Additionally, several other alternatives to animal experimentation exist within education and beyond, such as films and videos, plant experiments, ethically sourced cadavers, epidemiology and observational field research. While none of these alternatives can be used to singularly address and replace animal experiments, some scholars and researchers assert that the collective use of these alternatives can address the required learning objectives and skills in education (e.g. Gruber & Dewhurst, 2002). Thus, in educational settings, instructors and

universities have an assortment of alternatives that are available in replacement of animal experiments for a variety of pedagogical objectives. However, as previously discussed in Chapters Two and Four, there are various factors that prevent instructors and universities from adopting these alternatives. Current animal models are perceived as having faster publication rates, and more financial and professional gains for researchers who have built their careers around animal research (Almiron and Khazaal, 2016; Anderegg et al., 2002; Greek and Greek, 2010). Furthermore, as universities are a part of the animal research industry, they have vested financial interests in maintaining the use of animal experimentation in research and education (Noske, 1997; Sorenson, 2010). Therefore, the lucrativeness of animal experimentation prompts the continuation of this practice, despite the available alternatives.

Implementation of Alternatives in University Education

During the interviews, several students continued to assert that alternatives to animal experimentation are not advanced enough, and thus in need of more development before they can ever stand as a replacement for animal experimentation. However, several notable programs and universities have already successfully implemented alternatives to replace animal experimentation. As the Physicians Committee for Responsible Medicine (PCRM) (2016) states, "By 2016, none of the 202 accredited medical schools in the United States or Canada is known to use live animals for student training." Therefore, contrary to students' perceptions that alternatives are not developed and advanced enough to be used in replacement of animal experimentation, highly regarded medical schools such as Icahn School of Medicine at Mount Sinai, John Hopkins University and Harvard University have ceased using animal experimentation in their medical school programs (e.g. PCRM, 2016). Additionally, the

Memorial University of Newfoundland was the last medical school in Canada using animals for educational purposes, ceasing animal experimentation in October of 2010 (PCRM, 2016). Furthermore, Dr. Bruce Zetter of Harvard University expressed in an interview with *The New York Times* that the decision to stop using animals was for educational reasons to emphasize humans (rather than animals) in designing courses (PCRM, 2016). Despite these advancements in North American medical schools, the persistence of animal experimentation elsewhere is likely due to the abovementioned financial and professional incentives for continuing the use of animal experimentation in research, and subsequently in education to reproduce this.

While the use of alternatives in medical schools across North America is very promising, research and specialized medical training, such as emergency medicine residencies, advanced trauma life support programs, pediatric residencies and combat trauma training continue to use animal experimentation according to PCRM (2016). While the percentage of North American universities using animals in these specialized programs are declining, according to the PCRM (2016), some universities maintain a reliance on animal models outside of their standard medical school programs. Furthermore, if medical schools across North America can switch over from animal experimentation to sophisticated alternative methods, it seems plausible to assert that the technology is available and advanced enough to replace animal experimentation at the undergraduate level. While students expressed disdain for what they perceived as outdated technology on alternative methods, leading them to believe that alternatives are not ready to replace animal experimentation, in actuality highly sophisticated alternatives are available. Therefore, as previously discussed, it would appear that this has more to do with a lack of incentive to deviate from the status quo of animal research, than a lack of available technology for alternatives to animal experimentation. While the initial cost of upgrading and advancing

alternative technologies can be steep, the cost is far less in the long term when compared to purchasing and maintaining animals in labs (Patronek and Rauch, 2007). However, as universities remain a key site in the vivisection industrial complex, there could potentially be other capitalist motives for maintaining animal experimentation at Brock, as well as other universities (Almiron and Khazaal, 2016; Sorenson, 2010; Noske, 1997).

Moving Forward with a Humane Education Framework

The use of non-animal alternatives is significant for animals, as their lives are at the disposal of the scientific community, as well as for humans because of the increased reliability and transferability of alternatives compared to animal models. Therefore, in the application of humane education pedagogy, these issues can be addressed to benefit both animals and students. According to Eadie (2011), humane education is described as a process that can encourage an understanding of respect and compassion for people, animals, and the environment. Recognizing the interconnectedness of all living beings is important when seeking long-term strategies for alleviating the suffering of animals (Eadie, 2011). Through the critical approach of humane education, the work of critical pedagogy and critical animal studies can overlap, as many previous scholars have shown (e.g. Pedersen, 2010; Eadie, 2011; Kahn and Humes, 2009; Andrzejewski, 2003; Kahn, 2003). In order to incorporate this framework into a discussion on animal experimentation in particular, Eadie (2011) and Pedersen (2010) exemplify how humane education can be done by educating students on animal welfare issues, and providing education of alternatives to animal models. Additionally, Pedersen (2004) asserts that humane education can be used to explicitly identify and conceptualize speciesist hidden curricula in pedagogy. As animal objectification is normalized and embedded throughout education, it can be difficult for

most of us to detect speciesist power structures and the value systems behind them (Pedersen, 2004). However, as humane education prompts critical thinking on the interconnected relationships between humans, animals and the environment, it has the potential to combat explicit and hidden speciesist curricula.

A key Canadian example of this push towards humane education and alternative methods can be seen at the University of Windsor, through the Canadian Centre for Alternatives to Animal Models (CCAAM). The CCAAM was established in 2017 by Dr. Charu Chandrasekera, executive director of CCAAM and Director of Laboratory Science for the PCRM, and Dr. Andrew Hubberstey, academic director of CCAAM. The mission of the CCAAM is to promote human-centered alternatives to animal use in research, education and toxicity testing (CCAAM, 2017). Additionally, they aim to develop partnerships with academic, government, industry and public sectors, at local, national and international levels, to transition away from animal models and towards alternatives (CCAAM, 2017). The potential future development of these partnerships is incredibly important in their attempt to shift towards alternatives in the sciences, as it represents a holistic approach to the elimination of animal models across various public and private institutions.

The CCAAM (2017) states the academic initiative of "establishing first-of-its-kind academic degree programs in Animal Replacement Science to train the next generation of scientists, ethicists, and policy makers". This academic initiative coincides with Eadie's (2011) emphasis and acknowledgement of the potential impacts that teaching alternative methods in education can have on future generations in the sciences. Eadie (2011) explains that by incorporating humane education into pedagogy, more caring attitudes can be developed among future generations. This notion relates to Pedersen's (2002) assertion that students predominantly

align with the methods and values taught to them by their teachers. This suggests that students taught with humane education principles, through the use of alternatives to animal experimentation, may develop more compassionate views on the use of animals in science moving forward. Therefore, pedagogy is crucial in the long-term planning for the replacement of animal models with alternatives. However, since the CCAAM has only been announced and established in the summer of 2017, it is unclear at this time how these initiatives will play out and what the impact of this center will be on the overall use of animals in research and education, at the University of Windsor and beyond. Moreover, it is clear that within their academic, research and regulatory initiatives, the CCAAM will work to legitimize and validate alternatives in education and research more broadly.

Furthermore, other longer standing Canadian advocacy groups against the use of animals in education and research include Queen's Animal Defence, Animal Alliance of Canada, Stop UBC Animal Research and the Animal Defense & Anti-Vivisection Society of British Columbia. Queen's Animal Defence (QAD) is an advocacy group located on the Queen's University campus, in Kingston, Ontario. QAD's focus is on the use of animals in research and education. In terms of animal use in education, their short-term goals include advocating for transparency in animal use for educational purposes, a policy that informs students of their right to opt-out of animal use, and creating a budget to purchase alternative technologies. While their long-term goal is to fully replace the use of animals in education with non-animal alternative methods.

The Animal Alliance of Canada (AAC), established in 1990, is a non-profit organization dedicated to lobbying for animal and environmental protection laws, at municipal, provincial and federal levels of government. Pertaining to animal experimentation, the AAC currently has a "No Pets in Research" initiative, specifically addressing the practice of pound release, which is the

release or sale of cats and dogs from animal shelters to research and educational facilities (AAC, 2017). This practice is mandated under Ontario's *Animals for Research Act*, and the AAC aims to amend this act, banning the use of shelter animals in animal experimentation.

Additionally, the advocacy group Stop UBC Animal Research was established by its parent organization, the Animal Defense & Anti-Vivisection Society of British Columbia (ADAV), to expose and end animal research at the University of British Columbia. Furthermore, the ADAV works to inform the public of the conditions of animals used in experiments and promote the use of non-animal alternatives in research and education. Each of these groups outlined above, highlights Canadian mobilization efforts and initiatives working against the use of animal experimentation in education and research. Through these efforts, the use of alternatives to animal experimentation are promoted and encouraged in replacement of this practice.

While humane education can have significant and lasting impacts on students' perceptions of animals moving forward, animal subjectivities and voices are important considerations that need to be addressed in this discussion as well. The incorporation of animal voices is important in pedagogy to transcend sole focus on animal suffering, and the notion of animals as "voiceless", to include an intersectional pedagogy that prompts students to think about the social, cultural, and emotional lives of nonhuman animals (Corman and Vandrovcová , 2014). Subsequently, under a humane education framework, the social, cultural and emotional lives of animals should be highlighted, in addition to animal welfare issues and alternatives to animal experimentation. In practice, particularly for university classes that traditionally use animal experiments for behavioural studies, this could involve learning and observing animals in their natural habitat. This would give students the opportunity of learning about animal

behaviour in the animals' own social and cultural context, as opposed to in a manufactured lab setting. Furthermore, human and animal behaviour are both inextricably linked to our social, cultural and emotional lives, therefore these aspects should be highlighted in behavioural studies. As Corman and Vandrovcová (2014) assert, when students learn about animal voices and resistance, this gesture can move the conversation away from an orientation of human heroism and charity, and instead create a space for potential partnerships and solidarity with animals. Consequently, the inclusion of animal voices and subjectivities in humane education can transform the narrative of animals as victims to one that acknowledges their resistance, which should be a focus moving forward.

Concluding Remarks

In this thesis, I examined students' experiences of animal experimentation how student perspectives and understandings of animal ethics are shaped through their experiences of pedagogy. Using the research questions, "How do students experience animal experimentation, its teaching, and its place in the curriculum?" and "How do these experiences potentially influence students' understandings of animal ethics?" I have attempted to uncover the experiences of students and the influences of pedagogy on their understandings of animal experimentation at Brock University. Through the course of my six interviews, I was able to account for students' voice in regards to their educational experiences using animal experimentation. From my interpretation and analysis of these interviews, it has become clear that students' experiences of pedagogy and instructors are highly influential in their perceptions and acceptance of the use of animals for experimental purposes. Below, I will review each chapter, highlighting the main arguments from each, to synthesize the discussions throughout

this thesis. Then, I will consider the practical applications of my research, focusing on how to use this work to further the conversations on animal experimentation in university settings. Finally, I will explore potential areas of future research on animal experimentation pedagogy, to address some noteworthy areas that were beyond the scope of this thesis.

Chapter Reviews

In Chapter One, I provided a brief introduction into my project and the chapters that followed. Within this chapter, I mostly focused on a historical analysis of animal experimentation, to provide historical context for my current project. This historical analysis covered animal experimentation from antiquity, and the earliest records of its inception in the third and fourth centuries BCE, to present day. I expanded on this history in order to highlight that while the ways in which animal experiments are performed has changed, with advancements in technology, the principle of using animals for human benefits in research and education has persisted over time. Within this historical analysis, I also examined federal and provincial legislation on animal cruelty and animal experimentation more specifically, as well as the roles of the CCAC and the animal care committees, to explore the current systems in place to protect animals in Canada. Through this legislative analysis, it became clear that these current efforts are rendered useless in a climate where the interests of animals are constantly disregarded, in favour of the interests of researchers and institutions.

In Chapter Two, I detailed the contributions of past scholars and researchers on animal experimentation. I began by outlining the debates within the scientific community, between those for and against this practice, to understand the perceptions and positions of those in the sciences, which my participants would have likely already known. I then focused my attention on a review

of past literature examining students' perceptions and experiences of animal experimentation. Through this review I identified a clear gap in the lack of qualitative research on student perspectives and experiences of animal experimentation in a Canadian context, which my current project has addressed. Furthermore, within this chapter I highlighted literature that connects critical pedagogy and animal exploitation (e.g. Pedersen, 2004; Pedersen, 2010; Pedersen, 2002; Pedersen, 2002; Deguchi et al., 2012; Capaldo, 2004; Jukes and Martinsen, 2008). As students' perceptions and experiences can be influenced by pedagogy, both directly and in directly through the hidden curriculum, I incorporated critical pedagogy into my project to understand how pedagogy influences students' perceptions of animal experimentation. Throughout this literature review chapter, I explored the foundational works that my research has built off of.

Chapter Three provided an outline of the methodological approach and research methods that I have employed throughout my research process. I explored how I used a constructivist-interpretivist methodology in my project, and further account for the research methods that I employed in my research design, sampling, interview process and data analysis. I used qualitative in-depth interviews with six Brock University undergraduate students in the Faculty of Math and Sciences to attain my data. My sampling process involved the use of purposive sampling, quota sampling, and snowball sampling. Through this process I used recruitment posters around the Brock campus as my main sampling technique. Once my participants were established, my interview process involved individual one hour, semi-structured interviews. Following these interviews, I began my data analysis using an inductive approach and thematic coding process, grouping common themes across interviews into categories to be discussed in the subsequent data analysis.

In Chapter Four, I provided an analysis of the data. I began by outlining my two main theoretical frameworks, critical pedagogy and Critical Animal Studies, and how I was planning on incorporating them into my analysis. Then I addressed how animal experimentation is taught at Brock University to highlight the various educational atmospheres (e.g. lecture, lab, and online components) and instructors (e.g. professors, teaching assistants, and lab demonstrators), to understand the educational environments of the students. Following this discussion, I focused on a thematic analysis of my data, using the themes of acceptability, misconceptions in the debate on animal experimentation, gender differences, ethical ambiguities, absolution of culpability, lives of luxury, objectifying and obscuring language, and marginalization of alternatives. These themes represented the commonalities between the six interviews, which subsequently led into a discussion of how students' experiences of pedagogy and instructors were highly influential in shaping their perceptions and acceptance of animal experimentation. Therefore, the data affirm the findings of others suggesting that students are easily influenced to align with their educational authority figures, and the practices taught to them (e.g. Birke et al., 2007; Pedersen, 2010; Deguchi et al., 2012). In the case of animal experimentation, instructors influence students using a speciesist pedagogy and hidden curriculum, to shape students' understandings of animal experimentation as a necessary and essential aspect of their education.

Finally, in Chapter Five, prior to the concluding remarks, I discussed the alternatives to animal experimentation and how to move forward with a humane education framework. I began by detailing a few prominent examples of alternatives that can be used in education, such as computer simulations and models, student self-experimentation, in vitro and clinical work. While the initial start up costs of these alternatives may be steep, they are much more cost efficient than animal experimentation over time (Patronek and Rauch, 2007). Furthermore, as many notable

universities and programs have already began implementing alternatives in replacement of animal models, it proves that alternatives are not only available, but also sufficient in replacement of animal experimentation. Through humane education pedagogy, education can move forward promoting greater respect for humans, animals and the environment (Eadie, 2011). As outlined by Pedersen (2010) and Eadie (2011), this would entail educating students on animal welfare issues, as well as implementing alternatives to animal experimentation in science education. While the abovementioned alternatives and humane education pedagogy are crucial factors in eliminating animal suffering in educational experiments, the implementation of alternatives can be used beyond the realm of education and into the field of research, as many scientists and researchers against the use of animal experimentation have shown.

Practical Applications of this Research

Although my aim for this project was to generate a deeper analysis of students' perspectives and experiences in order to further the conversation about human-animal relations, bioethics, and the role of animal experimentation in universities, this research also has practical application value moving forward. While others interested in the perceptions and experiences of students engaging in animal experimentation, and the influences of pedagogy, can utilize and refer to my research, there are also applications beyond the realm of academia. As Glasser and Roy (2014) explain, the majority of academic work gets locked in the ivory tower of academia, whereby the knowledge gained through this research remains inaccessible to the general public, who may find it too arduous to decipher and engage with or may not have access to the databases and libraries. Consequently, Glasser and Roy (2014) problematize the ivory tower, as it can prevent scholarly research from reaching, and being used by, ordinary people who have the

potential to create incremental or radical change through activism. Through CAS, Glasser and Roy (2014) argue that an escape from the ivory trap is possible by connecting scholarship to practice and academia to activism. Thus, in accordance with Glasser and Roy's (2014) appeal to engage in praxis, theory to action, I present a few possible ways to enact this.

Overall, I have attempted to make this thesis accessible and to avoid obscure language or jargon, so as to avoid the confinement of this work within academic circles. Furthermore, as I move towards publication, I will explore more popular and accessible avenues in addition to academic journals, to reach a wider audience. As universities and institutions do not have to publicly disclose information regarding the use and practice of animal experimentation in education, the lack of transparency can make it increasingly difficult to challenge. By talking to students, I was able to gain valuable insight into the reproduction and maintenance of animal experimentation through education, how it is used in education, and how students are influenced by their instructors and pedagogy to accept this practice. Thus, my research can be used as a resource and reference for student and/or community-led activist groups who oppose animal experimentation in education.

Furthermore, the discussions with students regarding alternatives illuminated an important issue regarding resource allocation. Students who had experience using alternatives argued that the technology was outdated and far from educationally engaging. Additionally, several students mentioned that if there were adequate alternatives available they would be interested in using them instead of animal experiments; however, to their knowledge these alternatives do not exist. Therefore, perhaps if this information is disseminated it can be used to argue for more financial resources to be spent on improving the availability of alternatives. As previously mentioned, if medical schools across North American can replace animal models with

alternatives, then it is clear that technologically advanced alternatives are available and able to replace animal experimentation in undergraduate education as well.

Areas of Future Research

Through the course of this research project, some interesting avenues of exploration within the conversation of animal experimentation pedagogy were left untouched, as they were beyond the scope of this thesis. Although my research does contribute to the study of animal experimentation pedagogy and student perspectives and experiences, other areas of study are needed to fully understand the influences of pedagogy in relation to animal experimentation in education. As the participants in my sample were all largely in favour of animal experimentation in education, it would be equally as interesting to focus solely on interviewing students who oppose animal experimentation as a part of their education. Future research focusing on students against animal experimentation, from faculties and departments that this practice, would provide valuable insight into how and why they are challenging and opposing the animal experimentation pedagogy that is taught to them. Furthermore, this kind of research would also provide insight into how their instructors and schools are responding to such opposition, and what alternatives, if any, are offered as a replacement.

Additionally, my research included students from various years in their undergraduate degree; however, a comparative analysis of students at different educational levels (i.e. high school, undergraduate and Master's students) would aid in understanding if and how perceptions of this practice evolve over the course of their education. It prompts a closer examination of how the socialization of animal experimentation in education, from high school dissection to live

experiments in university settings, occurs and changes through those different stages and settings.

Furthermore, while I focused solely on interviewing students, future research could include interviewing professors as well, to understand the other side of the teacher-student relationship in regards to animal experimentation pedagogy. Perhaps a comparative analysis between professors and students, engaging in animal experimentation for educational purposes, could yield interesting results. This could include questioning their perceptions of animal experimentation and alternative methods, and in the case of professors, questioning how their own learning, from when they were students, has influenced their perceptions, experiences, and teaching of animal experimentation pedagogy as instructors. This kind of analysis would be interesting as it could illustrate to what extent students adopt the perspectives of their teachers, as well as any points of divergence between professors and students. These potential areas of future research could illuminate various other aspects of how animal experimentation is taught and how pedagogy influences students, and the impacts of this moving forward.

Through the course of this thesis, I have examined the perspectives and experiences of six Brock University students, to understand their thoughts on the educational use of animal experimentation. While each student offered a unique perspective, they shared similar sentiments regarding the impact and influence of their instructors and pedagogy on their perceptions and experiences with animal experimentation. Throughout the interviews, I began to realize that what really separated my perceptions from my participants' perceptions on animal experimentation was our education. While I had been taught through my courses in Critical Animal Studies to view animal experimentation as one of many forms of animal exploitation, my participants were taught to view animal experimentation as an essential part of science education and research.

Based on the conclusions drawn from this thesis, it appears that the acceptance of this practice is largely dependent on the pedagogy that one encounters. This further reinforces and centralizes the significance of pedagogy on students' perspectives, aligning with past scholars' arguments that students are likely to adopt the perspectives taught to them by their teachers (e.g. Birke et al., 2007; Pedersen, 2002; Pedersen, 2010; Deguchi et al., 2012).

While this project focuses on the perspectives of current students, it is also important to consider the future implications of their experiences of animal experimentation pedagogy moving forward. As Pedersen (2002) explains, one of the potential consequences of using animals as educational tools is that it can shape students' attitudes to preference animal experimentation in their future choices in research methods, if they move onto professional careers in research. This is supported by the studies illustrating that students tend to prefer and adopt the learning methods that they are predominantly taught and exposed to (e.g. Pedersen, 2002; Pedersen, 2010; Birke et al., 2007; Deguchi et al., 2012). Subsequently, the use of animal experimentation in education, despite the available alternatives, could greatly influence how future generations practice and conduct research. Additionally, the understandings gained through this research, specifically how students experience animal experimentation, its teaching, and its place in the curriculum, and how these experiences of pedagogy influence their understandings of animal ethics, can be used moving forward to expand on an examination of the future implications of this pedagogy. This thesis has allowed me to contribute to the critical conversation on animal experimentation in education, and will aid in the future work I intend to do on animal experimentation pedagogy and the incorporation of non-animal alternatives in undergraduate education.

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