

THE MORAL AND PRACTICAL CONSIDERATIONS OF
THE USE OF ANTIBIOTICS IN CONCENTRATED ANIMAL
FEEDING OPERATIONS ON NON-HUMAN AND HUMAN
POPULATIONS

by

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The use of antibiotics in Concentrated Animal Feeding Operations (CAFOs) in the United States needs to be morally and practically considered from a non-human and human perspective. The driving questions of the project concern the role of moral theories in concrete scientific and public policy decisions, the synthesis and reconciliation of non-human and human health, and the role of both philosophical and political actions in order to change the extreme instrumentalist paradigm. This thesis synthesizes research from multiple disciplines: philosophy, public policy, science, and environmental studies. Parts I and II are two distinct but interdependent sections that consider the use of antibiotics in CAFOs from a non-human and human perspective,

respectively. Part I evaluates the usefulness of utilitarianism, consequentialism, and deontology for non-human animal ethics. Deontology is a moral system that recognizes the inherent dignity and intrinsic value of certain subjects, dependent on philosopher and application. Kant's Categorical Imperative, which strives for moral perfection through *a priori* moral formulations, is only reserved for rational human beings, and human beings alone have intrinsic worth. Deep Ecology is Kantian in its foundational idea of dignity and intrinsic value, but the movement extends intrinsic worth to non-human beings and the environment. Because utilitarianism and consequentialism perpetuate the violent instrumentalist paradigm, the project concludes that deontology is needed in order to improve human relations with non-human beings. Deontology recognizes the inherent dignity and worth of certain subjects, which is dependent on philosopher and application. Part II focuses on human epidemiology, public health, and public policy and argues that the use of antibiotics in CAFOs is a disaster risk. In order to combat the public health concern, the project suggests possible domestic and global solutions based on the philosophical conclusions of Part I.

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I. Introduction

The ideal and practical relationships among philosophy, science, and public policy are crucial and complex intersections that are impacted by public opinion, norms, and the interests of institutions. In 2014, the world is confronted with a drastically changing climate, enormous economic disparities, and the emergence of superbugs resistant to Western medicines most advanced medication. All of these issues demand the attention of the global community and require interdisciplinary knowledge. The aim of this project is to understand social and environmental issues through a wide variety of perspectives in order to develop solutions that will acknowledge not just the concrete, but also the ideological origins of problems. Philosophy ought to be reflective of the material conditions of current society and be able to critically suggest ways in which humans can enrich their own lives, as well as the lives of the beings and environment upon which they are dependent. Moral considerations, such as the status of non-human animals, should be used to inform policy decisions that will have material consequences on the thriving of human, non-human, and other natural communities. Public policy is dictated by the philosophical and scientific paradigms of the historical moment because they help structure the lives of the people who hold the power to create and institute laws. However, science in United States politics has been used as reason for inaction, specifically in the antibiotic regulation debates. Falsifiability and uncertainty are components of strong scientific information because scientific information should never pretend to be all-knowing or universal for all-time. In U.S. politics, this idea has been inverted and it is actually the falsifiability and uncertainty of information that is used to create doubt regarding the usefulness of scientific information. While the general public

and governments should acknowledge the dynamic nature of science, they should not deny the usefulness of empirical knowledge based on uncertainty. In 2014, the convergence of philosophy, science, and public policy needs to be understood and expressed meaningfully in order to create innovative and thoughtful solutions to the world's social and environmental problems. Even though this project focuses its lens on antibiotic resistance, the methods of the following endeavor can be applied to a wide variety of questions and obstacles.

The use of antibiotics in CAFOs is problematic on both philosophical and practical grounds. In the United States, the use of antibiotic medication for non-therapeutic uses in CAFOs is extreme compared to the rest of the world and is largely unregulated by the Food and Drug Administration, an agency of the United States Department of Health and Human Services. This practice is a symptom of the current extreme instrumentalist paradigm and violates the inherent value of non-human animals in a deontological model. Deontology is a moral system that recognizes the inherent dignity and intrinsic value of certain subjects, dependent on philosopher and application. Kant's Categorical Imperative, which strives for moral perfection through *a priori* moral formulations, is only reserved for rational human beings, and human beings alone have intrinsic worth. Deep Ecology is Kantian in its foundational idea of dignity and intrinsic value, but the movement extends intrinsic worth to non-human beings and the environment. The abuse of antibiotic medication is also a disaster risk to human populations because of antibiotic resistance that is developed in CAFOs. Because of the consistent, non-therapeutic administration of antibiotic medication in CAFOs, bacteria are given the opportunity to build resistance to the same or similar

medication prescribed to combat human illness. The amount of new antibiotic agents created has severely dwindled since the late 1980s, due to the need for more complex antibacterial structures and the lack of monetary incentive for pharmaceutical companies to invest in research. Antibiotic resistance is a major threat to human health and has commanded the attention of leading organizations such as the World Health Organization and the U.S. Center for Disease Control. In order to protect the health of non-human and human populations, there needs to be a combination of moral and practical solutions on a domestic and global scale.

Part I briefly outlines a deontological approach to change the extreme instrumentalist paradigm that impacts the lives of non-human animals. In debates regarding the use of antibiotics in CAFOs, there has been little to no mention about how the medication impacts the concrete lives of non-human animals. Part II evaluates the epidemic risk for humans caused by antibiotic resistance and discusses the convergence of policy, science, and philosophy. The political recommendations in Part II are derived from the insights discussed in Part I regarding the application of deontology.

II. An Evaluation of the Usefulness of Utilitarianism, Consequentialism, and Deontology

Since the late 1940s, antibiotics have been used in concentrated animal feeding operations (CAFOs) for therapeutic and non-therapeutic uses. The most common non-therapeutic use is to promote growth, which increases profit margins for the meat and pharmaceutical industries. Livestock animals are administered antibiotics through their food and water sources on a consistent basis. The aim of Part I is to evaluate utilitarianism and deontology as relevant moral theories regarding animal ethics, explore applications of the classic models to animal and environmental ethics, and propose further changes needed to understand the depth of the issue.

The issues addressed here are: i. Conditions of animals in concentrated feeding operations are poor due to containment and disease outbreaks; ii. The Utilitarianism of Bentham, Mill, and today Singer may provide a theoretical framework to approach animal treatment in CAFOs; iii. Singer's liberation is plagued by same issues of classic Utilitarianism; iv. Modern Consequentialism cannot properly account for motive or actual consequences in CAFO facilities; v. Utilitarianism and Consequentialism reduce the inner lives of beings to the preferences of a group; vi. Quantitative and Qualitative Hedonism fail to present strong arguments for the protection of non-human animals; vii. Utilitarianism does not change the current extreme instrumentalist paradigm; viii. Kant's indirect duties towards non-human animals are anthropocentric; ix. Kantian Deep Ecology may encourage a paradigm shift in non-human animal and environmental ethics; x. Language has the power to impact norms regarding the human and non-human distinction; xi. Social and environmental interdependence may strike a balance between

two similar, but opposing movements; xii. Final comments about the usefulness of moral theories in the debates surrounding CAFOs.

Conditions of Animals in Concentrated Animal Feeding Operations

The conditions of animal feeding operations were revolutionized in America during the 1940s. It was a time of vast mechanization and efficiency and new technology and medicine made meat and dairy products more accessible to the American public. While animals used for meat and dairy were forced to suffer even before this, the magnitude and scope of animal suffering increased with the emergence of large facilities and operations. Since then, the conditions of concentrated animal feeding operations are worse because of the continuously increasing demand for meat and dairy products globally and the insufficiencies of the industry to balance animal welfare with profits.

Animals who are raised for meat or dairy purposes are forced to endure conditions that make it difficult to live with agency. Living space is one of the largest concerns for hens, sows, and dairy cows. Behavior is greatly restricted because of confinement and density and the animals are not able to perform normal functions such as “raise their wings or locomote freely” (Pew Center 2012). There are some advantages to concentrated conditions, like low piglet mortality rates, but overall, behavior restriction is harmful to animals because they are not able to perform functions they would otherwise need to do in order to survive. It also makes animals prone to behaviors they do not normally engage in, such as cannibalism in chicken populations. Other major problems in animal production derive from human handling, transportation, identification, food and water restriction, design of housing facilities, and air

contamination from ammonia (Pew Center 2012). Although different animals undergo different conditions because of body size and form, they all are subjected to immense suffering.

Disease is a large problem in animal feeding operations because of the confinement of the animals and the public fear that emerges during times of outbreak of certain diseases. Infectious diseases are risky because of the high concentration of animals and the ability for the rapid spread to allow “infectious organisms to mutate more quickly into highly pathogenic strains” (Pew Center 2012). When outbreaks occur, mass euthanasia of animals is common. While slaughter is a regular part of animal husbandry, the methods become worse when it needs to be done on a mass scale in a short amount of time. For example, chickens are euthanized by the use of “carbon dioxide, blunt force trauma, cervical dislocation” (Pew Center 2012). Those methods cause immense suffering beyond what is usually endured by animals during slaughter. Another method is the use of foam, which kills animals through the blockage of the airway to cause suffocation. Animal welfare advocates have called for further research into euthanasia practices during time of disease outbreak. Besides infectious diseases, animals are at risk of diseases, caused by solutions used to increase production (Garry 2004). A common example of this is heightened osteoporosis in hens due to calcium supplementation. The calcium assists with egg production, but puts the hens at high risk of broken bones during handling and transportation. Disease in livestock populations causes extreme pain for animals and is heavily associated with concentrated living conditions and modifications used to promote profits.

Modern Utilitarianism Through Bentham and Mill

Jeremy Bentham, founder of modern utilitarianism, wrote *An Introduction to the Principles of Morals and Legislation* in 1789. He introduces the Principle of Utility and the foundational role of pain and pleasure in the selection of actions. The Principle of Utility is the principle that evaluates the rightness or wrongness of an action based on the “tendency it appears to have to augment or diminish the happiness of the party whose interest is in question...to promote or oppose that happiness” (Bentham, 2). In order to do this, Bentham quantifies pleasure and pain into a moral calculus and the ultimate goal of a society is to maximize a positive outcome, that is, less pain and more pleasure. Bentham believes the amount of pain created from an action is calculated from seven circumstances (for a group); intensity, duration, certainty or uncertainty, propinquity or remoteness, fecundity, purity, and extent. When these are considered together, one can evaluate whether there is a net gain or loss in pleasure. Bentham is widely cited by utilitarian animal rights activists because he recognizes non-human animals may have the capacity to suffer. He asks “The question is not can they reason? Not, can they talk? But can they suffer?” (Bentham, 311). Although Bentham does not grant cognition to non-human animals, he is willing to claim they are capable of feeling pain beyond the instantaneous response of their bodies. Thus, all human and non-human animals who experience suffering ought to be included in the moral utilitarian calculus. Bentham’s theory sets the foundation for modern utilitarianism, which is based on the capacity to experience pleasure and pain.

John Stuart Mill, an English philosopher who lived in the 19th Century, opposed Bentham’s quantitative hedonism because of his distinction between higher and lower

pleasures. Mill creates a spectrum of pleasures in order to avoid reducing incommensurable experiences to the same amount of pleasure. The higher pleasures in life, such as engaging in philosophical debates and other actions that require cognition, may cause less immediate pleasure to an agent in the course of her life. Mill also claims a “cultivated mind...finds sources of inexhaustible interest in all that surrounds it; in the objects of nature, the achievements of art, the imaginations of poetry, the incidents of history, the ways of mankind past and present, and their prospects in the future” (Mill, 20). However, the quantity of the pleasure is not the determining factor in evaluating the rightness of an action. The lower pleasures, which include bodily sensations, are not the same in kind as higher pleasures because they don’t produce pleasures that can even be compared. Animals, according to Mill, are only capable of the lower pleasures and he famously states it is “better to be a human being dissatisfied than a pig satisfied” (Mill, 14). Thus, Mill’s qualitative hedonism is not just contingent on quantity of pleasure or the amount of subjects experiencing the pleasure, but is dependent on the quality of the pleasure experienced.

There are two main criticisms regarding Mill’s distinction about higher and lower pleasures. By hierarchically characterizing experiences, Mill runs into epistemological and social problems. Even if one assumes non-humans cannot experience higher pleasures because they do not form friendships or create art (both can be debated through recent evidence), humans are not in the all-knowing position to understand the extent to which non-human animals experience their everyday lives. Simple tasks and pleasures, such as eating, may bring as much pleasure to a cow as poetry does to an English major. Since a human cannot experience what other humans

and non-humans endure daily, one cannot make the claim higher pleasures are inherently, qualitatively higher than the lower ones. The other issue with Mill's argument is the classist assumptions it presumes. While it may be argued every human engages to some degree in higher pleasure, Mill reserves a cultured mind for those who have access to education or leisure time. Any pleasure that is derived from bodily experience, such as manual labor, cannot be as valuable as exercises of the mind. These considerations are significant to address in light of Peter Singer's work and his application of utilitarianism to animal rights.

Singer's Utilitarianism

Peter Singer, who is often credited with igniting the contemporary animal rights movement, published *Animal Liberation* in 1975. In that book, he provides a detailed account of the treatment of livestock in factory farms and dairy farms. Because of the immense suffering endured by non-human animals, Singer calls for an *animal liberation movement*. Liberation is necessary to “demand for an end to prejudice and discrimination based on an arbitrary characteristic” (Singer iv). Livestock animals, such as cows, pigs, and chickens, need to be freed from their oppressive roles in society through a paradigm shift. Non-human animals have a right to “equal consideration,” in utilitarian moral calculus (Singer, 2). This does not mean human and non-human animals are entitled to the same treatment and rights (such as the right to vote) but it infers both groups need to be equally recognized as possessing the ability to suffer. Non-human animals are capable of having interests because the “capacity for suffering and enjoyment is *a prerequisite for having interests at all*” (Singer, 57) . If a creature can feel pain, it has an interest to avoid situations that cause pain and engage in

circumstances that increase enjoyment. Furthermore, the utilitarian argument does not depend on the consciousness or cognitive capacity of the creature. Even if there were strong evidence to suggest non-human animals do not possess inner lives, they would still be worthy of equal consideration in Singer's theory. Singer concedes pain can never be felt from an external observer because it is an internal event of consciousness. However, he believes pain can be inferred from external indications, such as "writing, facial contortions, moaning, yelping or other forms of calling, attempts to avoid the source of pain, appearance of fear at the prospect of its repetition" (Singer, 12). Since verbal communication is ineffective between human and non-human animals, non-verbal communication is a necessary component in the evaluation of pain. There have been numerous scientific studies to suggest non-human animals do suffer. These studies extend beyond primates and have included organisms such as fish (Braithwaite 2010).

Singer's form of utilitarianism is in the tradition of Bentham because of the quantitative hedonism, but he still perpetuates Mill's ideas through his emphasis on consciousness. Bentham's Principle of Utility and his moral calculus are applied to non-human animals in virtue of the fact they can suffer and experience pain. Evaluation of one's actions should consider the net positive and negative outcomes, which are not based on quality of experience but on quantity. However, Singer integrates Mill's hierarchical structure through priority of beings with higher consciousness capacity. He is often criticized by people who disagree with abortion or people in disability studies because he states "killing, say, a chimpanzee is worse than the killing of a gravely defective human who is not a person. At the present the killing of a chimpanzee is not regarded as a serious matter" (Singer, 97). He extends this idea to infants as well

because he believes people who seem to have low mental capacities or consciousness are of lesser priority than animals who demonstrate high cognitive ability and self-awareness. Although this is not in the exact line of Mill's distinction of higher and lower pleasures, Singer still hierarchically structures who's pleasures and pains are prioritized based upon mental capacity. Although he focuses on Bentham's tradition of utilitarianism, he still incorporates Mill's distinctions.

Singer believes humans have treated animals poorly because of speciesism, defined as a "prejudice or attitude of bias in favor of the interests of members of one's own species against those of members of other species" (Singer, 6). Singer rejects the mechanistic view of living things and grants the ability to experience pleasure or pain to other animals. The consumption of meat is deeply entrenched in Western tradition, culture, and language. Habit is the "final barrier that the Animal Liberation movement faces," because it requires a shift in the diet, norms, and expectations of American society (Singer, 6). Singer hopes human empathy regarding pain will outweigh their desire for meat. Even though meat heavily dominates the American diet, there have been numerous studies to suggest meat is not necessary to receive one's daily protein intake (National Institute of Health 2006). Singer's extension of utilitarianism to animal ethics propelled the liberation movement forward in public debate, but is ultimately unable to escape the issues embedded in Bentham and Mill's conceptions of utilitarianism.

Consequentialism

Consequentialism, a theory that encompasses utilitarianism, holds that the moral rightness or wrongness of an act is dependent on the consequences of the act. Acts do

not possess inherent rightness or wrongness because rightness or wrongness are dependent on the chain of events that are caused by the action. There are many different kinds of consequentialist theories, such as motive consequentialism and actual consequentialism. Motive consequentialism considers the agent who is responsible for the action and her intended consequences for doing the action. Even if the intentions are to maximize happiness, there are still circumstances in which the action may produce more harm than good. Motive and subjective consequentialism argue the agent is not morally wrong if there is a disconnection between intended and actual consequences. This view is criticized because of the difficulty of knowing the nature of one's intentions since external factors, like speech, can be deceiving and mask one's motives. Actual consequentialism holds that an act is morally right or wrong according to the *actual* consequences and does not take into consideration foreseen, foreseeable, intended, or likely consequences. The agent is removed from consideration and the action is evaluated solely on what actions it brought about in the world.

Motive consequentialism can be applied to animal ethics and CAFOs, but there are certain points of clarification that need to be made in order to evaluate it on those grounds. First there needs to be a definition of who or what is the agent that directly causes the outcome. There may be some debate whether this is the owner of the facility who requires the use of antibiotics, but one could argue it is the worker in the facility who is directly responsible since she is the one administering the medication through the feed. These are two different agents with two different motives, but one could argue the basis of their actions originates from the desire to create a profit through the use of antibiotics. However, the owner or the board of directors of CAFOs are more

responsible because they most likely possess the knowledge of what antibiotics are and what they do, whereas a worker may not be fully aware and less able to know the consequences of their actions. Also, the owners have the power to accept or reject the use while the often marginalized and destitute worker is controlled by the threat of losing her job. With this in mind, it is more appropriate to have the responsible agent as the person or people in the administration who require the use of antibiotics in their facilities. Assigning responsibility in this way is in line with how contemporary corporate and business structures assign responsibility and liability to top corporate officials.

The main reasons for the use of antibiotics are to treat disease, control disease, prevent disease, and promote growth (Pew Center 2012). The promotion of growth is an example of a non-therapeutic use of antibiotics, which means animals are given antibiotics when they are not sick or need the medication. The intended consequence of the use of antibiotics is not to improve the conditions of livestock animals because that use is for primarily non-therapeutic purposes. The motive behind the unregulated use of antibiotics is to produce larger animals in order to create more profit for a small percentage of people. The intended consequence does not promote the wellbeing of the livestock animals and concentrates any positive monetary consequences from the action in the hands of those people in power.

The *actual* consequences of the overuse of antibiotics is useful for evaluating the moral rightness or wrongness of the action because it does not depend on a specific agent and their internal motives. When antibiotics were first introduced to CAFOs in the 1940s, they were used because they promoted growth in the animals. In 2013, this is

still a large factor for continuing the trend. However, antibiotics have also contributed to the problem of confined space and behavioral constriction in animal facilities. Animals who are raised for meat or dairy purposes are forced to endure conditions that make it difficult to live with agency. Behavior is greatly restricted because of confinement and density of animals, which results in animals not able to perform normal functions such as “raise their wings” (Pew Center 2012). CAFOs are able to confine non-human animals to small living spaces with sometimes unsanitary conditions because of the use of antibiotics. In 1979, the congressional Office of Technology Assessment claimed “present production is concentrated in high-volume, crowded, and stressful environments, made possible in part by the routine of use in antibacterial feed” (Office of Technology Assessment 1979). The administering of antibiotics makes it possible for non-human animals to be extremely confined.

Reductionism and Lack of Individualization in Utilitarianism and Consequentialism

Utilitarianism and consequentialism make it extremely difficult to recognize the individuality in every sentient being because these views reduce people and animals to quantities and groups in order to make decisions. This is done in order to evaluate the consequences on certain or all groups because the goal is to maximize happiness for the whole of society or in the case of animals, of a biological group.

Rule utilitarianism attempts to create happiness through general rules that, if universally applied, will generate the most happiness. Rule utilitarianism, which attempts to “construct an ideal moral code to govern the behavior of the totality of moral agent”, does not take into account the specifics of the agent or the victim of the

agent because it attempts to generalize actions (Emmons, 6). The moral “rightness or wrongness of a particular action is a function of the correctness of the rule of which it is an instance”(Garner, 70). Although rule utilitarianism may not yield the optimal results in every particular situation, the hope is that if it is applied by everyone, the rule will create the most happiness. The actions which are generalized are hypothesized to create the most net positive outcome in society, as long as everyone follows them.

Reduction to large, sometimes irrelevant groups is a significant problem in environmental ethics. Non-human animals are viewed as one entity without any particularities to differentiate them from one another. As a result, it is easier to diminish or harm non-human animals because they do not have the same unique agency as a human being possesses. The only exception is possibly some primates and large animals, such as Kanzi and Keiko. Kanzi is a Bonobo who has learned to communicate with a lexigram board with over 350 symbols (Rafaelle 2006). Killer whales, such as Keiko, are capable of developing and transferring culture and engaging in social interactions (National Institute of Health 2007). Non-human organisms are commonly reduced to ambiguous, vague terms such as *nature* or *wilderness*. Because utilitarianism requires the reductio of individual, particular beings to mere collections of similar entities, it is not able to adequately challenge the current, harmful paradigm of reducing non-human animals to meaningless groups.

Issues with Quantitative and Qualitative Hedonism

Quantitative and qualitative hedonism both present problems when considering the non-human animals in CAFOs. In 2012, the U.S. human population was 313.9 million people (United States Census Bureau 2012). In 2002, there were an estimated

890 million animals in large feeding operations (Mittal, 16). If one accepts that humans and non-human animals deserve equal consideration, where no being represents less or more than one, then the suffering of animals should account for double what the suffering of humans does based on sheer quantity. However, quantitative hedonists could argue even if the number of non-human animals is much greater than the amount of humans, human suffering is greater because of Bentham's seven areas of consideration. The way in which to account for sentient beings seems simple at first, but Bentham's method is ambiguous and can be manipulated to maximize or minimize suffering of a certain group because of the subjective evaluation of the hedonist.

Qualitative hedonism is less adequate than quantitative hedonism to account for non-human animal suffering because it creates a binary of higher and lower pleasures. Higher pleasures are a result of highly cognitive actions and exercises while lower pleasures are constituted by bodily sensations and very simple actions. Mill argues they are different in kind and do not have equal consideration in his moral calculus. If non-human animals are not able to engage in higher pleasures, then only human happiness is prioritized. It can be argued that animals do possess inner lives and can have meaningful experiences, such as advanced communication with other members of their species or different species. Does this not constitute higher pleasure and cognitive ability? In Mill's conception of qualitative hedonism, even advanced communication is not enough to be considered eligible to experience higher pleasure. As a result, human well-being will always outweigh non-human animal considerations.

Conclusion Regarding the Usefulness of Utilitarianism

Utilitarianism and consequentialism fail at challenging the current paradigm regarding non-human animal treatment in CAFOs. Motive and actual consequentialism can argue there may be some moral violations regarding the use of antibiotics in CAFOs because of intended and concrete consequences. However, they are not strong enough to overcome the issues of reductionism, qualitative, and quantitative hedonism. The theories perpetuate and reinforce the same paradigm of extreme instrumentalism and are not useful in addressing the core problems of animal treatment in CAFOs. Therefore, the focus of this project will shift to deontology in order to evaluate its value in animal ethics, especially in regards to antibiotic overuse in CAFOs.

Kant's Deontology and Duties to Animals

Deontology, as proposed by Immanuel Kant in *The Foundations of the Metaphysics of Morals*, recognizes the inherent value and dignity of human beings. Kant's Categorical Imperative, which strives for moral perfection through *a priori* moral formulations, rests on two formulations. The first formulation states to "act only on that maxim whereby thou canst at the same time will that it should become a universal law" (Kant, 39). The second formulation is stated as "Humanity as an End in Itself" and argues a rational being "*exists as an end in himself, not merely as a means to be arbitrarily used by this or that will*" (Kant, 428). Rational beings should never just have mere instrumental value, but possess intrinsic value in and of themselves. Kant does not include non-human animals in the Categorical Imperative they are "not self-conscious and are there merely as a means to an end. The end is man" (Kant, 239). Humans do not have direct duties towards animals because the treatment of animals is

considered through “indirect duties towards humanity” (Kant, 240) . If one abuses or kills an animal for no reason, the act is morally harmful because it “damages in himself that humanity which it is his duty to show towards mankind”(Kant, 240). Animal mistreatment is not morally wrong because it is a violation of non-human animal intrinsic value, but because it harms duties humans have to other rational beings.

Kant’s view is problematic not only for non-human animals, but also for human beings who are deemed to lack rationality. Because of Kant’s emphasis on rationality and free will, the Categorical Imperative cannot be applied directly to animal ethics. Human beings possess autonomous wills, which is a mark of rational expression needed in order to recognize the formulations of the Categorical Imperative. One wills to develop herself and bettering her own life, while also possessing the Universal Law of Nature or the “Idea of the will of every rational being as *a will that legislates universal law*” (Kant, 432). In order to enact human will, rational beings use maxims. The structure of a maxim is the following: “I will *A* in *C* in order to realize or produce *E*” (Stanford Encyclopedia, 9). *A* represents a particular action, *C* is a particular circumstance, and *E* is an end realized through the enacting of *A* in *C*. Human willing is predicated upon reason because only rational creatures can formulate and understand ends. As a result, only rational creatures are ethical because they are the only ones who can follow the Categorical Imperative. Kant excludes non-human animals, as well as other beings who seem to lack reason, because they cannot reciprocate applications of the Categorical Imperative and as a result, only deserve indirect duties.

Kantian Moral Theory through Deep Ecology

During the 1970s, there was an emergence of environmental ethics that shaped diverse movements that each had a different set of goals, problems, and solutions. Deep ecology is one of the threads that has its origins in this time period, and has been regarded as a very radical shift in view as compared with the current paradigm. It is Kantian in its values because it is based on the notions of intrinsic worth and inherent dignity. But it is an extension of Kant in applying those notions to non-human life and the environment. Deep ecology, as proposed by Arne Naess, Neil Evernden, and Fritjof Capra, expresses the necessity to reject anthropocentrism, to view the universe as an unpredictable subject that possesses intrinsic value, and to extend this change of perception to concrete action. Naess is responsible for coining the term “Deep Ecology” and has been followed by numerous supporters and critics, such as Evernden and Capra in the 1980s and 90s.

Proponents of deep ecology are deeply critical of the current paradigm that places humans above nature, accepts the concept of a mechanical universe, and doesn't extend value to nature beyond its worth to humans. They are concerned about the “crisis of perception,” an extreme anthropocentric view of the world, because it provides humans logical justification for environmental abuse and disregard for non-human life (Capra, 21). Deep ecologists argue the main root of ecological degradation doesn't originate from social structures or economic conditions, but rather a perceptual flaw that bases its value system around humans. Additionally, all value in nature is derived from the instrumental use it can provide for human-determined ends. Nature is “disenchanted” as it's a part of the mechanized universe that is governed by laws,

instead of an unpredictable, self-determining, and holistic entity. Thus, it can be manipulated and analyzed in terms of its parts, which further perpetuates anthropocentrism and view of the world as a “collection of isolated objects” (Capra, 22). Deep ecologists shed light on the anthropocentric worldview, the notion of a mechanized universe, and instrumental value of nature as the root causes of environmental issues that must be changed in order to create meaningful, long-lasting impacts.

In order for the paradigm shift to occur, deep ecologists argue that humans must recognize the interconnectedness of the earth, accept the inherent value in nature, and view nature as a miraculous subject. Capra mentions what separates deep ecology from other forms of environmentalism is that it “recognizes the intrinsic value of all living beings and views humans as just one particular strand in the web of life” (Capra, 25). Humans and nature are inextricably linked and therefore are greatly impacted by the well-being or destruction of each other. Tom Regan, who Arne Naess refers to in *The Deep Ecological Movement*, explains intrinsic value as the recognition of value “independent of any awareness, interest or appreciation of it by any conscious being” (Regan, 50). Beyond this, Neil Evernden encourages humans to view nature as an “extension of self-hood...with whom one has relationships similar to those within human society” (Evernden, 193). The consequences of this shift are to recognize the “rights and obligations within nature, or even of a morality of nature” (Evernden, 193). If one understands the extension of self as granting subjectivity to it as other human beings supposedly grant to other humans, this implies the valuing of the other as possessing inherent value. Evernden suggests the need to restore the view of “nature as

miracle”, which basically restores the beauty, mystery, and unpredictability to nature that Western science has claimed to understand and manipulate (Evernden, 196). By not just understanding nature as mere variables to be understood through parts, deep ecologists argue an environmental ethic will emerge.

Arne Naess outlines eight points he believes are critical in order for humans to live harmoniously with nature. Naess calls for a necessary change of institutional policies that “affect basic economic, technological, and ideological structures” (Naess, 50). These changes would put the quality of life for the human and non-human life above economic growth and would support science if and only if it was beneficial to all forms of life. He also argues that the “flourishing of non-human life *requires* a smaller human population” (Naess, 51). There is a further political dimension to Naess’s environmental philosophy. Naess believes deep ecology “requires global action: Action across borders” (Naess, 51). This belief should be emphasized because it’s the basis of a major criticism of Naess’s work, as will be discussed later in this section. Through his eight point platform, Naess addresses the necessary ideological as well as political, economic, and social shifts that need to occur in order to live a balanced existence with nature. Deep ecology and its Kantian roots are critical insights into the ideological shifts that are needed in order to recognize the intrinsic value of human, non-human beings, and the environment. In order to bring forth the goals of the previous sections, two concrete changes need to occur.

As argued in the first part of the chapter, utilitarian moral theory is insufficient because it cannot account for individual animals’ value in a meaningful way. In order to partly dissolve the strict barrier between human and non-human animals, the

reconstruction of language is necessary. One of the strongest criticisms of deep ecology is its reassertion of the distinction between human and non-human animals through its lack of attention to social injustices and its high prioritization of environmental health over human health. However, in order for a Kantian approach to be accessible to people of all backgrounds and privileges, there needs to be a recognition of the interdependent connection between social injustice and environmental degradation.

Combating Reductionism and the Non-Human/Human Distinction with Language

Utilitarianism is insufficient to meaningfully contribute to animal ethics because it reduces whole groups of non-human animals to single units with single preferences and needs. By reducing non-human animals to quantifiable units, they are easily used as objects through instrumental rationalism. One way to address this concern is through shifting the language and terms used to describe non-human animals in a way that respects their inherent dignities and unique traits that make them irreplaceable beings. Jacques Derrida, in his lecture called “The Animal That Therefore I Am” recognizes this difficulty in Western Philosophy. Derrida argues “*animal* is a word that men have given themselves the right to give,” which is done “in order to corral a large number of living beings with a single concept” (Derrida, 11). The first problem is that humans have isolated themselves through negation of *what they are not* in order to assert their hierarchical superiority to other beings. Second, the term *animal* or *animality* cannot encompass a “multiplicity of heterogenous structures and limits” (Derrida, 12). Humans have reduced non-human animals to a mere unit “that is simply opposed to humanity,” as a way to assert a necessary difference among human and non-human beings (Derrida, 14). By doing this, humans are committing acts of “violence and willful ignorance”

because they are negligent about their place within the earth community (Derrida, 18). Although differences among humans and non-humans need to be developed, it is no different than differentiating between a squid and an octopus. Beings may be different in form and function, but they should be asserted through their own subjectivity as opposed as to what traits they have or do not have. Constructing language that accounts for this ethic is a crucial step in formulating new norms regarding the subjectivity and inherent dignity of all animals.

Social and Environmental Degradation Interdependence

One significant aspect of improving the lives of all animals is the recognition of the similarities between human and non-human abuse and degradation. Deep ecology and other extreme forms of environmental ethics are often criticized as perpetuating strict definitions between humans and non-humans by asserting non-human wellbeing ought to be placed above the interests of human communities. Arnae Naess explicitly states he believes “governments in Third World countries are mostly uninterested in deep ecological issues”. However, this places blame and responsibility on already marginalized communities and does not recognize the role of the accepted economic system in environmental and social injustices. Murray Bookchin in “What is Social Ecology?” recognizes the link between social inequality and environmental degradation. Bookchin acknowledges the “sheer survival requires an entrepreneur [to] expand his or her productive apparatus to remain ahead of other entrepreneurs and try, in fact, to devour them” (Bookchin, 293). Progress in the global economic system does not focus on the betterment of all animals, but instead on the concentration of wealth and power through maximization of profit. Although some deep ecologists may claim social

ecology is not *deep* enough, it is actually in accordance with their principles because it “does not separate humans from the natural environment, nor does it separate anything else from it” (Bookchin, 294). It is anthropocentric to claim economic injustice is just a human issue, because it impacts the entire system, not just human communities. In order to improve the treatment of all animal communities, we must recognize the interconnectedness between economic injustice, social concerns, and environmental abuse. Animals born into the commercial agriculture system are a part of the larger societal problem of mechanization of labor and extreme instrumentalism. If the issues of all animals are to be addressed, it needs to be recognized that human thriving is connected to and not opposed to non-animal thriving and success. In order for the inherent dignity of all living beings is to be respected, human-constructed problems, such as the economic exploitation and lust for profit, need to be resolved.

Final Remarks

The overuse and misuse of antibiotic medication in CAFO facilities is one symptom of the greater ideological and moral problems surrounding the ways in which humans, non-humans, and the environment interact with one another. Philosophy has the ability to expose new considerations to those who are responsible for the evaluation and institution of laws, agencies, and regulations. The debate on antibiotic use in CAFOs has grossly ignored the concrete and philosophical implications on the lives of non-human animals. Classical utilitarianism and modern consequentialism may not be able to radically transform the current paradigm, but a deontological approach has the ability to dramatically change the ways humans regard the subjectivity of non-human animals.

Part II analyzes the epidemiology risk created by antibiotic resistance and focuses on the role of legislation. The possible solutions listed at the conclusion of Part II are based upon the philosophical conclusions about the value of deontology at the end of Part I.

II. The Potential Consequences of Antibiotic Resistance on Human Health and the Necessity of Domestic and Global Initiatives

Epidemics, or the phenomena of widespread disease, have ravaged through living organisms for thousands of years. Although epidemics existed before the rise of modern technology, factors such as the overuse of antibiotic medication, motorized transportation, and rapid climate change, have heavily contributed to the increased scope and frequency of threatening diseases in the 21st Century. Mitigation of worldwide epidemics caused by antibiotic resistant bacteria, would require more comprehensive, detailed regulations regarding CAFOs and the use of pharmaceutical drugs and methods of waste disposal. It cannot be predicted if or when practices of CAFOs will result in epidemics, but the United States can reduce the risk of widespread disease by regulating the U.S. meat and pharmaceutical industries.

The Precautionary Principle should be taken seriously in debates regarding the regulation of antibiotics. Science is inherently value-laden. Even though it cannot provide purely objective or certain knowledge, science should be used to assess risks and inform decision-makers about consequences of action and inaction. The Precautionary Principle recognizes the “perceived potential for serious negative consequences,” and believes it is “better to avoid the action entirely rather than to suffer the potential consequences” (Antibiotic Resistance, 185). Thus, decisions should be made in order to mitigate the possible negative impacts, even if it sacrifices short-term gain or interests. Even though regulation of antibiotic medication could cause some economic concerns in the agriculture industry, it is better to avoid actions that could create larger problems in the long-term.

Bacteria, such as Methicillin-Resistant Staphylococcus Aureus (MRSA) and Salmonella, are examples of pathogens that are becoming extremely hard to treat through antibiotics. In the U.S., there are 9,900 large CAFOs that raise cattle, pigs, and poultry (Natural Resources Defense Council, 2014). The Natural Resources Defense Council reports approximately 80% of antibacterial medication sold in the U.S. is used for livestock. In 2011, there were 29.9 million pounds of antibiotics sold for meat and poultry production and 7.7 million pounds of antibiotics for human consumption (National Resource Defense Council 2014). The promotion of human health requires a combination of local, domestic, and international policies and initiatives in order to mitigate and prepare for possible outbreaks caused by antibiotic resistant bacteria.

Part II will include the following sections: i. The current state of affairs in CAFOs; ii. Ways in which antibiotic overuse and misuse have a direct impact on human public health; iii. How human health is threatened through environmental degradation; iv. A list of possible solutions to mitigate and prepare for epidemic threats, based upon philosophical conclusions in Part I; v. Final remarks.

Antibiotic Use in CAFOs

Since the late 1920s, antibiotic medications have been used to combat infections in human and non-human populations. Bactericidal medicines “induce cell death,” while bacteriostatic medications “inhibit cell growth” (Kohanski 2010). Medication-resistant bacteria result from either spontaneous genetic mutation or the genetic exchange between bacterium. The spontaneous mutations are rare and are believed to occur in about one per one million to one per ten million cells (Kohanski 2010). Resistance can also be passed genetically from one bacterium to another through

conjugation. When a bacterium is introduced to antibiotic medication, the drug may destroy the entire cell. However, over a period of time, a part of the cell may start to build resistance and pass the genetic information to its offspring. Eventually, antibiotic medication does not impact the resistant bacterium and is only able to combat the weaker bacteria that do not have the stronger genetic makeup. Another form of disease transmission may occur through viruses and their abilities to attack and inject resistance traits among bacteria cells. Bacteria have the capacity to become resistant to many antibiotics, which cause *superbugs* to emerge.

Non-human animals in CAFOs are administered many of the same antibiotics used to treat human illness. Cephalosporins, Ionophores, Lincosamides, Sulfonamides, Tetracyclines, Aminoglycosides, Macrolides, Penicillin and Streptogramins are critical medications for human health and used to treat a large variety of infections (Antibiotic Resistance, 187). About half of the antibiotics administered to non-human animals are almost identical in biochemical makeup to those prescribed to humans (Kaufman 2000). In 2013, the Center for Disease Control published a comprehensive report regarding factors that contribute to antibiotic resistance and a list of infections that pose a threat to human health. Examples of urgent and serious threats include *Clostridium difficile*, *Neisseria gonorrhoeae*, *Campylobacter*, gram-negative bacteria, and *Salmonella* (Center for Disease Control 2013). Many of the agents listed in the report were highly treatable with antibiotics a few decades ago, but have since mutated into forms that even the most advanced and strongest antibiotics are not able to treat. While antibiotic resistance cannot be fully attributed to CAFO misuse, the Food and Drug Administration, the Center for Disease Control, Union of Concerned Scientists, and the

World Health Organization have made public statements regarding the current and potential danger of this practice for human health. CAFOs have become breeding grounds for deadly bacteria that are able to withstand the only solutions modern science can provide at this point in human history.

Risks to Humans

Antibiotic resistance created in CAFO facilities is not merely a projected threat, but has already has known consequences. Several organizations, epidemiologists, and scientists, such as the World Health Organization and the Center for Disease Control, have made public statements regarding their concern about resistance, based on peer-reviewed studies from multiple countries. Transmission of bacterial infections from CAFOs can occur through direct and indirect contact. The first way is from immediate contact with infected animals. In a scientific study conducted in the Netherlands, researchers concluded the persistence of Livestock Associated MRSA CC298 in human populations is dependent on the intensity of contact with animals (Haitske 2011). They chose 51 veal calf farms to visit and used a sample size of 155 individuals who were either living or working on one of the farms. After the analysis of swab samples and the questionnaires regarding life style and other risk factors, the research group concluded that MRSA is strongly associated with the frequency of animal contact. This is due to the observation that the MRSA prevalence decreases with a decrease in animal exposure and that exposure to MRSA-positive animals increases the risk for farm workers and their families. It is important to note that the study acknowledges that environmental contamination with antibiotics may have been a contributing factor to the high MRSA rates in farmers. There have been numerous studies conducted in the United States

tracing salmonella and other bacterial infections in humans to CAFO facilities through bacterial-strain analysis (Fey 2000; Swartz 2002; Gupta 2003; Chapin 2005; Ramehandi 2005).

Another method of direct transmission is from the contamination of food. According to the National Antimicrobial Resistance Monitoring System, “eighty percent of the meat randomly tested...shows traces of antibiotic-resistant bacteria” (Antibiotic Resistance, 108). Some of the pathogens include MRSA, Salmonella, and E. Coli. Although the contamination can be minimized by using proper handling and cooking techniques, food remains a major source of bacterial infections.

Bacteria are also passed indirectly through genetic material. As Admiral Khan, Director of the Center for Disease Control, explains, “specific genetic material within a bacteria of animals can move into bacteria of humans” (Antibiotic Resistance, 256). Even if it is not exactly the same bacteria being transferred, the “resistant pattern moves into humans and then can cause human resistant bacteria” (Antibiotic Resistance, 257). Workers and other people who come into close contact with the facilities are at risk for this type of transmission.

Antibiotic medications have saved countless lives and have been hailed as *wonder drugs* because of their abilities to treat infections that once ravaged human populations. However, it is becoming increasingly difficult to develop new antibacterial agents. As seen in Figure 1, there has been a drastic decrease in the amount of new medicine since the 1980s. Dr. Arjun Srinivasan, associate director at the Centers for Disease Control and Prevention, attributes the decrease to a variety of factors, such as the complexity of creating new agents, the lack of incentive for pharmaceutical

companies to invest in antibiotics, and the time and research necessary to put new drugs on the public market. Dr. Srinivasan claims the first antibiotics created were the “low-hanging fruit,” of medicine (PBS 2013). Coupled with the economic “reality that many of the drug companies left this [antibiotic] market because of financial realities,” the creation of antibiotic agents has come to a screeching halt (PBS 2013). Dr. Carl F. Nathan, chairman of the department of microbiology and immunology at Weill Cornell Medical College, shares a similar view about the financial obstacles in the pharmaceutical industry. As opposed to heart or cholesterol medicine, antibiotics are needed for short-term use and have a short commercial life, because bacteria are constantly developing resistance. In 2014, the amount of monetary investment required to create new agents overshadows the potential profit of antibiotic medications. Although there have been some efforts on the part of GlaxoSmithKline and the Bill and Melinda Gates Foundation to create open-source labs to encourage collaboration among scientists and government officials, the industry does not view the creation of new antibiotic medications as a priority.

“Contagion,” an American movie released in 2011, follows the lives of people on the front lines of an epidemic. Although the plot and characters are dramatized, the thriller exposes the vulnerabilities of the globalized world. In 2014, people are able to travel through several different time zones in a matter of hours. One of the main characters in the film carries a deadly pathogen from Beijing to New York and instigates an epidemic in the United States. Epidemiologists scramble to identify the virus and quarantine the patients, but it quickly becomes impossible to identify everyone who may have been contaminated by patients. Admiral Khan, in his

Congressional hearing, is cognizant of the same issue because he claims the “moment you get a resistant bacteria from animals that makes its way into the human population, there is a different set of drivers for maintaining it in humans that makes it impossible to shut it down” (Antibiotic Resistance, 261). A recent and striking real life instance of this issue occurred in 2011 at the National Institute of Health’s Clinical Center. In the Intensive Care Unit, a strain of antibiotic resistant *Klebsiella pneumoniae* killed seven patients and colonized at least 19 others. The pathogen showed extreme resistance even when a contaminated ventilator was “cleaned three times with two different disinfectants” (New England Journal 2012). Furthermore, microbiologists were not able to identify patients who were infected due to lack of real-time technology. *Klebsiella* produces “silent carriers,” which means people who are contaminated may not exhibit any symptoms but still have the capacity to transmit the disease. The outbreak exposed the inefficiencies of the current system of quarantine and disinfection in one of the most equipped places in the United States to combat infectious pathogens. While one wants to avoid an alarmist perspective, it is crucial to understand the risks associated with antibiotic resistance and recognize the possibility of an epidemic stemming from a resistant pathogen.

Risks to Humans through Environment

CAFOs are not closed-loop systems. Although there are efforts to contain or regulate waste created in facilities, it is difficult because of the sheer amount of matter that is produced by the non-human animals. CAFOs are the “number one polluter of American waterways” (Donohoe 2011). Each year, 1.4 billion tons of waste is produced from CAFOs, which is 130 times more than annual human waste production (Donohoe

2011). As a result, waste is collected in vats, sewage lagoons, or used on agricultural fields for fertilizer. The waste “pollutes groundwater with harmful nitrogen and pathogens,” and can even cause “tens of millions of gallons of untreated waste into streams and estuaries, killing millions of fish” (Union of Concerned Scientists 2008). Huge spills have occurred on several occasions in the United States, including an incident in 1995 that left 25 million gallons of manure in the New River and killed approximately 10 million fish (National Resource Defense Council 2014). Sewage leaks of this nature have the potential to cause dead zones, areas of reduced levels of oxygen that result in a “biological desert” (National Oceanic and Atmospheric Administration 2014). Another concern is the transferal of antibiotics through manure. Since the antibiotics are administered orally through feed and water, the medicines are processed by the animal’s digestion system. However, the medication is frequently “not fully metabolized” and can exist in waste (Center for Disease Control 2013). When the waste is used as fertilizer or is leaked into a water system, the antibiotics can “leech into groundwater or surface water” (Center for Disease Control 2013). This is another way how the overuse of antibiotics could impact the efficiency of the medication for human purposes. Waste from CAFOs present a wide variety of challenges because of the sheer amount produced per year and the lack of prioritization to properly process the waste.

Manure leakage is dangerous to human health because of the transmission of pathogens. Fecal matter is one way pathogens, such as *Salmonella* and other bacteria that cause severe diarrhea and abdominal pain, are transferred from CAFOs to human populations. Although some strains have not mutated enough to impact human health, there are about “150 pathogens in manure that could impact human health” (Center for

Disease Control 2013). Since antibiotic-resistant bacteria exists in CAFO facilities, there is a possibility that they could also be spread through manure. CAFO waste is also a point of concern because of the opportunities for insect vectors, such as houseflies:

The John Hopkins Bloomberg School of Public Health found evidence that houseflies near poultry operations may contribute to the dispersion of drug-resistant bacteria (Center for Livable Future, 2009). Since flies are attracted to and eat human food, there is a potential for spreading bacteria or pathogens to humans, including microbes that can cause dysentery and diarrhea (Bowman et al., 2000) (Center for Disease Control 2013)

Environmental degradation is a general indirect risk to human health. Water pollution is harmful for aquatic life, soil quality, and human well-being. Manure and other waste is a major problem for CAFO facilities and surrounding areas and puts human communities at risk for low amounts of water and for the spread of antibiotic resistant pathogens.

Possible Solutions

Antibiotic resistance is an issue that transcends national boundaries. Because one country's actions can impact the rest of the world, the solutions to this issue need to take both a domestic and international approach. In the United States, there has been some legislation aimed at limiting antibiotic use and requiring transparency about how and which medications are used in CAFO facilities. However, none of the relevant laws have passed through Congress. While the Food and Drug Administration regulates the use of medications, food, and consumer goods, they still remain under control of the U.S. federal government since as an agency under the United States Department of

Health and Human Services. The main objections against legislation appeals to the uncertainty of scientific information and the potential financial consequences to the agriculture business. On a national scale, there are several requirements outstanding: more transparency, a measure of what constitutes prevention as opposed to overuse, an appeal to the precautionary principle, and an emphasis on scientific literacy. Globally, a consensus should be developed about the importance of antibiotic stewardship and the importance of preparation. Solutions to antibiotic overuse and the threats of epidemics, outlined in the following section, are applications of the philosophical discussions of Part I regarding the need to turn to a deontological framework.

Transparency and Definition of “Prevention”

In the United States, there is a tension between transparency and private information. Currently, there is no legislation regarding what information pharmaceutical companies or CAFOs need to report to the Food and Drug Administration. In 2013, Energy and Commerce Ranking Member Henry A. Waxman proposed the “Delivering Antibiotic Transparency in Animals (DATA) Act”. This act would require pharmaceutical companies to notify the FDA about how their products are used in CAFOs. It would also require feed mills to report to the FDA about the kinds, purposes, and amounts of antibiotics administered to the non-human animals through their food and water. Although the FDA and other organizations can acquire some information, there is no legislation that requires transparency. With more accurate data, scientists would be able to conduct better studies and to access the magnitude of the overuse with more clarity. For example, one barrier to pass legislation is because of the undetermined definitions of “disease prevention” and “use for growth promotion”.

Some people opposed to legislation are concerned that there will be more disease and uncleanliness in CAFOs because they believe the current level of antibiotics used prevents outbreaks. On the other side, the people who propose legislation are also concerned with the same question because of potential loopholes that would just perpetuate the current misuse. If there was more accurate data regarding the amount of antibiotics used, what kind were purchased, and how they were used, scientists and veterinarians would be better able to assess what the line is between disease prevention and growth. Also, the information could also lead to questioning whether there is even a valuable purpose in using antibiotics for any type of prevention, because any use may be deemed an overuse. Transparency should be demanded by the public, government officials, and health agencies, because it concerns the public well-being.

Scientific Literacy

The role of science in American politics is precarious and breeds uncertainty and fear. Science is never absolute and is dependent on the values, norms, and practical limits surrounding the research (Kuhn 1968). Even though one may always see white swans, there is always a possibility one will encounter one black swan that would totally refute one's previously held convictions (Popper 1934). Still with all of these considerations in mind, Western science still provides one of the best methods for understanding the physical world. In the DATA Act Congressional Hearing transcript, it is evident the most used argument against legislation is about the uncertainty of science and the lack of scientific consensus about the risks of antibiotic overuse. This trend, seen also in climate change debates, exposes the need for scientific literacy on multiple levels. Politicians, stakeholders, workers, and the general public need to be able to

interpret scientific studies and evaluate information that may present pseudo-science or is not from reliable sources. As a whole, American media news sources do not provide all the information needed for a comprehensive view of an issue. People need to be able to understand the information from the primary source instead of relying on secondary sources to inform their opinions. Scientific literacy needs to improve drastically in the United States in order to make informed decisions about a variety of issues.

Global Initiative

Antibiotic-resistant bacteria not only impact countries with high medication misuse, but constitute a global threat. Thus, it will require a global prioritization of the issue in order to decrease the risk of an emergent pathogen. It is difficult to pass domestic legislation or international agreements regarding the issue because it is an example of a Tragedy of the Commons. The Tragedy of the Commons occurs when the individual desire for personal gain leads to a common failure or destruction of resources. Garrett Hardin, an American ecologist, assumes each actor is a “rational being,” who acts in order to “maximize his gain” (Hardin 1968). Antibiotic medication is globally available to any country, company, or person who can afford to purchase them. Because the agricultural business believes it is economically rational in the short-term to use antibiotics, any kind of international, voluntary agreements are very difficult to construct. While each nation should continue to propose legislation to limit antibiotic use in CAFOs, they should also propose disaster preparedness policies. As opposed to mitigation, preparedness encourages people, organizations, and governments to be aware of the risks of disasters, to build resilience, and to consider organizational and moral questions before a disaster occurs. One way in which the international

community can become more prepared for bacterial epidemics is through international organization that uses a variety of human and monetary resources to develop new antibiotic agents and to study further the function and form of current antibiotic medication and threatening pathogens. In an op-ed in the New York Times titled “Teaming Up To Make New Antibiotics,” Dr. Carl Nathan (see section on “Risks to Humans”) discusses international developments surrounding antibiotic research. GlaxoSmithKline, Tres Cantos Open Lab Foundation, and the Bill and Melinda Gates Foundation have all created open labs on an international scale. Nathan also mentions the use of an intergovernmental fund in order to create incentives for profit-driven drug companies (New York Times 2012). Not only does this plan take advantage of a diversity of minds, skills, and talents, an open lab with open patents allows for countries who do not have many resources to have access to life-saving information. In 2014, countries in the Global North and South are divided by monetary gaps, but also by information and technology differentials. If antibiotic-resistant pathogens start a global epidemic and only privileged countries and companies own patents to the best medicine, the most vulnerable people of the world would suffer disproportionately. International open-source, open-patent labs are one way in which the global community can build resilience and preparedness.

Preparation Planning and Citizen Initiative

Citizen initiative and local preparation planning on local and national scales also play an important role in the antibiotic-resistance discussion. Although federal agencies hold the power to regulate medication, local governments and citizens can initiate their own plans, standards, and epidemic guidelines. Local residents have the ability to

establish their own norms and practices about how they will handle events before an epidemic disrupts everyday life. Community resilience is critical in withstanding disasters and establishing normal conditions quickly.

Final Reflections

The misuse and overuse of antibiotic medication in CAFOs can be understood through a wide variety of perspectives. Philosophy is critical to understand the moral dimensions concerning the lives of non-human animals, as well as the people who are vulnerable to potential disasters. Science that is conducted and reviewed by trusted sources also plays an crucial role in assessing the risks of legislative action or inaction, as well as developing norms and expectations about the world. Public policy authorities need to critically and thoughtfully consider knowledge and recommendations from philosophical and scientific experts in order to create interdisciplinary and innovative solutions to the world's largest social and environmental problems. The aim of this project has been to synthesize information from multiple disciplines in order to analyze the use of antibiotics in CAFOs and expose the fundamental interconnectedness among human beings, non-human communities, and the environment.

The aims of Part I and II are to analyze the moral and practical considerations about the use of antibiotics on non-human and human populations. Although the two parts are in conversation with each other philosophically, they do differ in their conclusions about deontology and utilitarianism. Part I, which focuses on non-human animal ethics, concludes that deontology trumps utilitarianism in its value for changing the current extreme instrumentalist paradigm used in CAFOs. Part II, even though it attempts to create solutions based on the philosophical conclusions of Part I, still

appeals to the utilitarian model in application to human beings. This seems to create tension within the thesis, but it instead exposes opportunities and ways in which different moral systems can be applied to specific circumstances. The use of a deontological model ought to be a goal for public policy. In this particular circumstance, however, a utilitarian system needs to be used because it is the logic of the current paradigm. Without swift and meaningful legislation and citizen initiative, humans will continue to place themselves, as well as non-human animals, at greater epidemic risk. Parts I and II suggest the use of different moral systems to promote non-human and human wellbeing.

Antibiotic resistant bacteria is a looming threat the government and the public can no longer ignore. The overuse and misuse of antibiotic medication in CAFOs needs to be monitored and regulated in order to help mitigate and prepare for an epidemic. Domestic and international communities will need to create new sets of norms, policies, and organizations in order to properly address the global issue. While scientific information is never absolute, the Precautionary Principle should be evoked because it will, at the very least, promote healthier, more sustainable agricultural methods. The role of antibiotics in CAFOs needs to be taken seriously in American politics because it is a risk to the American public, as well as the global community. While Part I focused on the moral paradigm regarding non-human animals, Part II shifted the focus to human epidemiology, policies, and disaster mitigation and planning. The solutions discussed at the end of Part II are general applications of a deontological approach that was discussed in Part I.

Figures

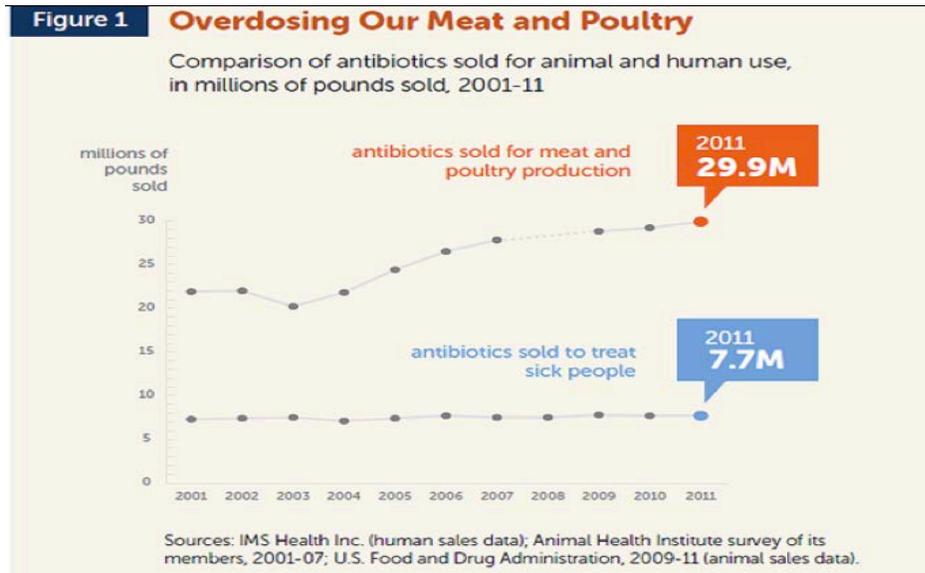
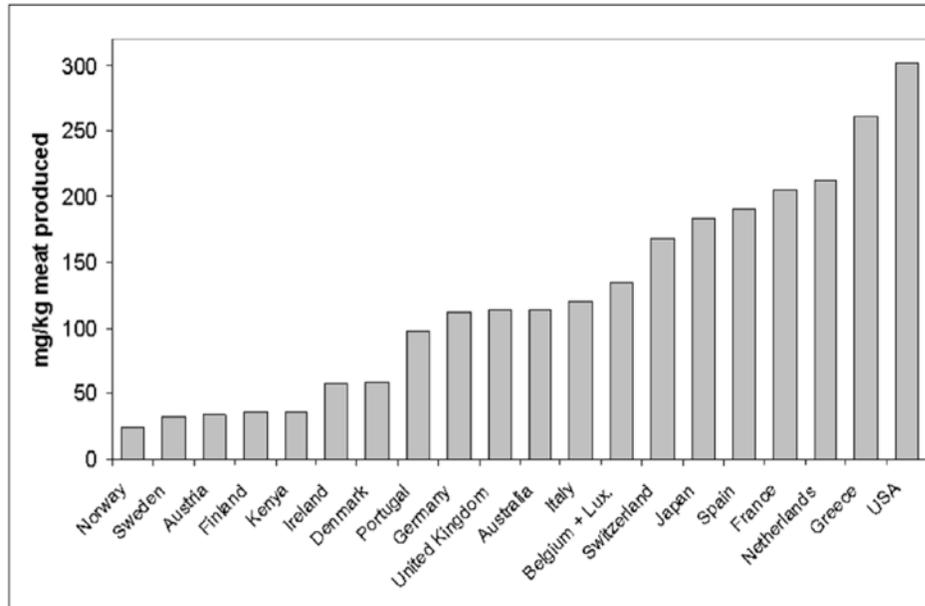


Figure 1: Overdosing Our Meat and Poultry



Source: IMS Health Inc.

Figure 2: Milligrams of Antibiotics Used Per Kilogram of Meat Produced

Source: TGen Centre for Microbiomics and Human Health

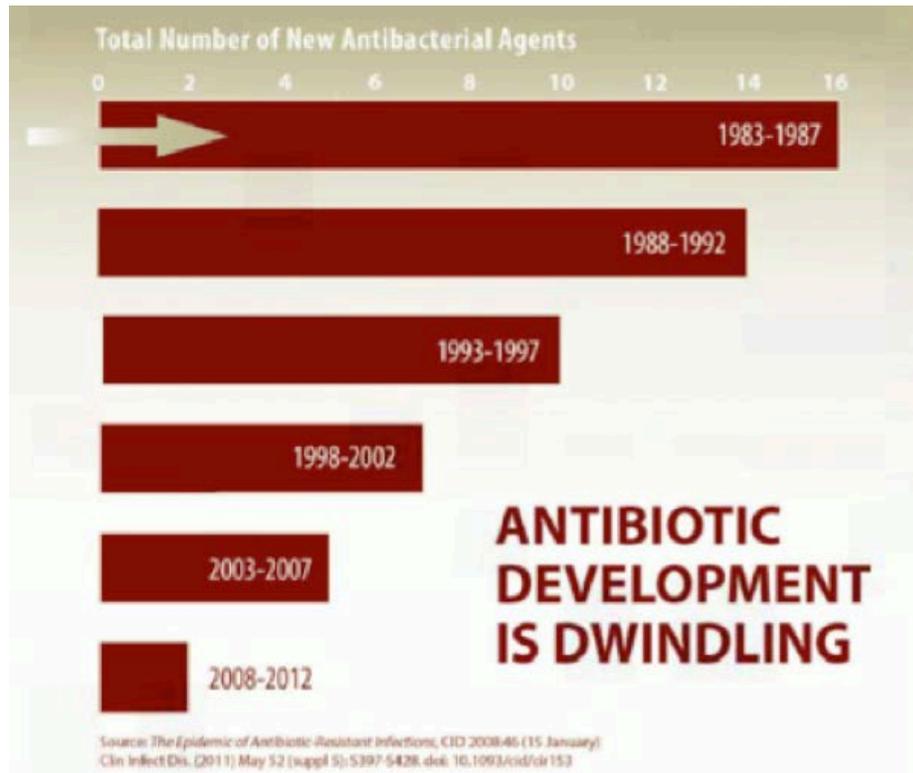


Figure 3: Antibiotic Development is Dwindling

Source: *The Epidemic of Antibiotic Resistant Infections*, CID 2008

Tables

Animal Sector	Size Thresholds (number of animals)		
	Large CAFOs	Medium CAFOs ¹	Small CAFOs ²
cattle or cow/calf pairs	1,000 or more	300 - 999	less than 300
mature dairy cattle	700 or more	200 - 699	less than 200
veal calves	1,000 or more	300 - 999	less than 300
swine (weighing over 55 pounds)	2,500 or more	750 - 2,499	less than 750
swine (weighing less than 55 pounds)	10,000 or more	3,000 - 9,999	less than 3,000
horses	500 or more	150 - 499	less than 150
sheep or lambs	10,000 or more	3,000 - 9,999	less than 3,000
turkeys	55,000 or more	16,500 - 54,999	less than 16,500
laying hens or broilers (liquid manure handling systems)	30,000 or more	9,000 - 29,999	less than 9,000
chickens other than laying hens (other than a liquid manure handling systems)	125,000 or more	37,500 - 124,999	less than 37,500
laying hens (other than a liquid manure handling systems)	82,000 or more	25,000 - 81,999	less than 25,000
ducks (other than a liquid manure handling systems)	30,000 or more	10,000 - 29,999	less than 10,000
ducks (liquid manure handling systems)	5,000 or more	1,500 - 4,999	less than 1,500

¹Must also meet one of two "method of discharge" criteria to be defined as a CAFO or may be designated.

²Never a CAFO by regulatory definition, but may be designated as a CAFO on a case-by-case basis.

Table 1: Definitions of Large, Medium, and Small CAFOs

Source: Environmental Protection Agency

Bibliography

- ANTIBIOTIC RESISTANCE AND THE USE OF ANTIBIOTICS IN ANIMAL AGRICULTURE*, One Hundredth Eleventh Congress, 185 (2011) (testimony of Dr. Randall Singer). Print.
- ANTIBIOTIC RESISTANCE AND THE USE OF ANTIBIOTICS IN ANIMAL AGRICULTURE*, One Hundredth Eleventh Congress, 51 (2011) (testimony of Dr. Ali Khan). Print.
- ANTIBIOTIC RESISTANCE AND THE USE OF ANTIBIOTICS IN ANIMAL AGRICULTURE*, One Hundredth Eleventh Congress, 108 (2011) (testimony of Honorable Janice D. Schakowsky). Print.
- Alliance for the Prudent Use of Antibiotics. "The need to improve antimicrobial use in agriculture: Ecological and human health consequences." *Clinical Infectious Diseases*, 2002 supplement. 34(S3): S71- 144.
- Akwar, T.H., C. Poppe, J. Wilson, R.J. Reid-Smith, M. Dyck, J. Waddington, D. Shang, N. Dassie, and S.A. McEwen. "Risk factors for antimicrobial resistance among fecal *Escherichia coli* from residents on forty-three swine farms." *Microbial DrugResistance*, 2007. 13(1): 69-76.
- Angulo, F.J., V.N. Nargund and T.C. Chiller. "Evidence of an association between use of antimicrobial agents in food animals and antimicrobial resistance among bacteria isolated from humans and the human health consequences of such resistance." *Journal of Veterinary Medicine*. 2004. 51: 374- 379.
- Bentham, Jeremy. *An Introduction to the Principles of Morals and Legislation*. Whitefish, MT: Kessinger, 2010. Web.
- Campagnolo, E.R., K.R. Johnson, A. Karpati, C.S. Rubin, D.W. Kolpin, M.T. Meyer, J.E. Estaban, R.W. Currier, K. Smith, K.M. Thu and M. McGeehin. "Antimicrobial residues in animal waste and water resources proximal to large-scale swine and poultry feeding operations." *The Science of the Total Environment*, 2002. 299: 89-95.
- Catry, B., H. Laevens, LA. Devriese, G. Opsomer and A. Kruif. "Antimicrobial resistance in livestock." *Journal of Veterinary Pharmacology and Therapeutics*, 2003. 26: 81-93.
- Center for Disease Control. *Antibiotic Resistance Threats in the United States, 2013*. 13 April 2013.

- Chee-Sanford, J.C., R.I. Aminov, L.J. Krapac, N. Garrigues-Jeanjean and R.I. Mackie. "Occurrence and diversity of tetracycline-resistance genes in lagoons and groundwater underlying two swine production facilities." *Applied and Environmental Microbiology*, 2001. 67(4): 1494-1502.
- Corpet, D. "An evaluation of methods to assess the effect of antimicrobial residues on the human gut flora." *Veterinary Microbiology*, 1993. 35(3-4):199-212.
- Derrida, Jacques, and Marie-Louise Mallet. *The Animal That Therefore I Am*. New York: Fordham UP, 2008. Print.
- Emmons, Donald C.. *Act vs. Rule Utilitarianism*. Mind New Series, Vol. 82, No. 326. Oxford University Press. April, 1973. pp. 226-233. Print.
- Evernden, Neil. "Nature in Industrial Society." *Environmental Ethics: Divergence and Convergence*. By Susan J. Armstrong and Richard George Botzler. Boston: McGraw-Hill, 2004. N. pg. 191. Print.
- Fey, P., T.J. Safranek, M.E. Rupp, E.F. Dunne, E. Ribot, P.C. Iwen, P.A. Bradford, F.J. Angulo and S.H. Hinrichs. "Ceftriaxone-resistant *Salmonella* infection acquired by a child from cattle." *New England Journal of Medicine*, 2000. 342: 1242-1249.
- Garner, Richard T.; Bernard Rosen (1967). *Moral Philosophy: A Systematic Introduction to Normative Ethics and Meta-ethics*. New York: [Macmillan](#). p. 70. Print.
- Garry, FB. *Animal well-being in the US dairy industry*. In: *The Well-Being of Farm Animals: Challenges and Solutions*. Benson GJ, Rollin BE (eds). Ames, IA: Blackwell. 2004.
- Goforth, R.L. and C.R. Goforth. "Appropriate regulation of antibiotics in livestock feed." *Boston College Environmental Affairs Law Review*, 2000. 28(1): 39-77.
- Glynn, M.K., C. Bopp, W. Dewitt, P. Dabney, M. Mokhtar and F.J. Angulo. "Emergence of multidrug-resistant *Salmonella enterica* serotype Typhimurium DT104 infections in the United States." *New England Journal of Medicine*, 1998. 338(19): 1333-1338.
- Graham, J.P., L.B. Price, S.L. Evans, T.K. Graczyk and E.K. Silbergeld. "Antibiotic-resistant *Enterococci* and *Staphylococci* isolated from flies collected near confined poultry feeding operations." *Science of the Total Environment*, 2009. 407(8): 2701-2710.
- A. J. W. Kluytmans. "Methicillin-resistant *Staphylococcus aureus* in food products: Cause for concern or complacency?" *Clinical Microbiology and Infection*, 2010. 16(1): 11-15.

- Kant, Immanuel, and Mary J. Gregor. *Foundation of the Metaphysics of Morals*. Cambridge, U.K.: Cambridge UP, 1998. Print.
- Kant, Immanuel, and Louis Infield. *Lectures on Ethics*. Torchbook ed. Gloucester, Mass: P. Smith, 1978. Page 239. Mill, John Stuart. Scarre, Geoffrey. *Utilitarianism*. London: Routledge, 1996. Web.
- Kohanski, Michael A., Daniel J. Dwyer, and James J. Collins. "How Antibiotics Kill Bacteria: From Targets to Networks." *National Center for Biotechnology Information*. U.S. National Library of Medicine, 04 May 2010. Web. Mar.-Apr. 2014. <[http:// www.ncbi.nlm.nih.gov/pmc/articles/PMC2896384/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2896384/)>.
- McEwen, S.A., P.J. Fedorka-Cray. "Antimicrobial use and resistance in animals." *Clinical Infectious Diseases*, 2002. 34 (Suppl 3): S93-106.
- Mittal, Anu. Concentrated Animal Feeding Operations: EPA Needs More Information and a Clearly Defined Strategy to Protect Air and Water Quality from Pollutants of Concern. Washington, D.C.: U.S. Government Accountability Office, 2008. Print.
- Myers, K.P., C.W. Olsen, S.F. Setterquist, A.W. Capuano, K.J. Donham, E.L. Thacker, J.A. Merchant and G.C. Gray. "Are swine workers in the United States at increased risk of infection with zoonotic influenza virus?" *Clinical Infectious Diseases*, 2006. 42: 14-20.
- Naess, Arne. "Basic Principles of Deep Ecology." *Environmental Ethics: Divergence and Convergence*. By Susan J. Armstrong and Richard George Botzler. Boston: McGraw-Hill, 2004. Print.
- Nathan, Carl F. "Let's Gang Up on Killer Bugs." *The New York Times*. The New York Times, 09 Dec. 2012. Web. 08 Mar. 2014.
- National Oceanic and Atmospheric Administration, "Dead Zone" Is a More Common Term for Hypoxia, Which Refers to a Reduced Level of Oxygen in the Water." *What Is a Dead Zone?* 23 Jan. 2014. Web. 07 May 2014. <<http://oceanservice.noaa.gov/facts/deadzone.html>>.
- National Resource Defense Council. "Environmental Issues: Food and Agriculture." *NRDC: Saving Antibiotics*. 7 Feb. 2014. Web. 08 Apr. 2014. <<http://www.nrdc.org/food/saving-antibiotics.asp>>.
- Naess, Arne. "Basic Principles of Deep Ecology." *Environmental Ethics: Divergence and Convergence*. By Susan J. Armstrong and Richard George Botzler. Boston: McGraw-Hill, 2004. Print.
- "Pew Campaign on Human Health and Industrial Farming." *Pew Campaign on Human Health and Industrial Farming*. N.p., n.d. Web. 21 Feb. 2014.

- Price, L.B., J.P. Graham, L.G. Lackey, A. Roess, R. Vailes and E. Silbergeld. "Elevated risk of carrying gentamicin-resistant *Escherichia coli* among U.S. poultry workers." *Environmental Health Perspectives*, 2007. 15(12):1738-1742.
- Public Broadcasting Service. "Dr. Arjun Srinivasan: We've Reached "The End of Antibiotics, Period"." *PBS*. 13 Oct. 2013. Web. 07 Apr. 2014.
- Raffaele, Paul. "Speaking Bonobo." History, Travel, Arts, Science, People, Places | Smithsonian. N.p., Nov. 2006. Web. 20 Feb. 2014.
- Sandora, Thomas J., and Donald A. Goldmann. "Preventing Lethal Hospital Outbreaks of Antibiotic-Resistant Bacteria." *New England Journal of Medicine*. New England Journal of Medicine, 6 Dec. 2012. Web. Mar.-Apr. 2014.
- Sessions, George, and Fritjof Capra. "Deep Ecology for a New Paradigm." *Deep Ecology for the Twenty-first Century*. Boston: Shambhala, 1995. N. pg. 19-26. Print.
- Sherman, Doug G. *CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations*. Rep. Union of Concerned Scientists, Apr. 2008. Web. 8 Apr. 2014. <http://www.ucsusa.org/assets/documents/food_and_agriculture/cafos-uncovered.pdf>.
- Swartz, M.N. "Human diseases caused by foodborne pathogens of animal origin." *Clinical Infectious Diseases*, 2002. 34 (Suppl 3): SI11-122.
- U.S. House of Representatives, Committee on Science and Technology, Subcommittee on Investigations and Oversight. 1979. Hearing: *Contract with Seattle*. U.S. Government Printing Office: Washington, DC.
- United States of America. Centers for Disease Control. "*Understanding Concentrated Animal Feeding Operations and Their Impact on Communities*." Carrie Hribar. Ed. Mark Schultz. National Association of Local Boards of Health, 2010. Web. <http://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf>.
- Wegener, H.C., F.M. Aarestrup, P. Gerner-Smidt and F. Bager. "Transfer of antibiotic resistant bacteria from animals to man." *Acta Veterinaria Scandinavica Supplementum*, 1999. 92: 51-57.
- White, D.G., S. Zhao, R. Sudler, S. Ayers, S. Friedman, S. Chen, P.F. McDermott, S. McDermott, D.D. Wagner and J. Meng. "The isolation of antibiotic-resistant *Salmonella* from retail ground meats." *New England Journal of Medicine*, 2007. 345(16):1147-1154.
- Zimmerman, Michael E., and Murray Bookchin. "What Is Social Ecology?" *Environmental Philosophy: From Animal Rights to Radical Ecology*. Upper Saddle River, NJ: Pearson/Prentice Hall, 2005. Print.

