Broadening Bioethics

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Jun 27, 19

1. Introduction

The academic world loves academic structure, e.g., disciplines, fields, departments, programs, and schools. To some extent this is beneficial. Serious thought requires distinctions. Analytic methods rely on dividing and conquering the material under examination. Disciplines provide resources for these activities through their canons, methodologies, and vocabularies. They shape the questions that are asked, and help to define what counts as answers. Even when this love affair is not good it is often relatively harmless. Identifying with a discipline or department is like belonging to a guild or a union, or cheering for the home team. Some people like wearing a team uniform more than other people, but this is not a matter of great concern.

However, to some extent, this love of academic order is pernicious. It can be more like sophisticated (but still vicious) forms of tribalism than conformity to sensible epistemological canons. The love of institutional distinctions can distract or deflect us from the most urgent problems we face. These problems do not respect the order of battle imposed by university administrations and policed by college professors, graduate students, and professional organizations. They come to us in their own terms. Thus, if we want to make progress on some of these problems, we must follow where they lead, rather than attempting to impose on them our favored categories of thought.

In this paper we discuss the past, present, and future of bioethics. Bioethics has a fractured history: Some philosophers have associated it primarily with health ethics and others have associated it primarily with environmental ethics. More recently, these lines have blurred, in part because questions about health and the environment are increasingly intertwined and structural. We discuss several ethical issues where questions about health and the environment play a central role, individually as well as structurally. These issues include the health and environmental effects of food, war, and climate change. We claim that, if we want to make progress on these issues, then we will have to expand the scope of bioethics – and we will have to regard it as an open, empirical question how we should expand it.

Of course, other academic fields purport to address health and environmental issues too. Insofar as they do, the questions that we raise in this chapter about the scope of bioethics apply to these fields as well. More generally, we should also ask whether we need new academic fields, or a new division of labor across academic fields, to attend to the kinds of multidimensional problems that we now face. We are inclined to think that we do. But since this issue is beyond the scope of the chapter, we will not press that point here. Instead, we will illustrate our point about the scope of bioethics by considering a few topics (among many) that we think bioethicists should be addressing more, insofar as we purport to address health and environmental issues in our field.

2. The Origins of Bioethics

In the United States at least, bioethics has a clear if relatively unknown history. The term was coined by Van Rensselaer Potter, an oncologist of Dutch extraction, who spent his entire career at the University of Wisconsin. Within months the same term was being used in a quite different way by André E. Hellegers, a Dutch obstetrician-gynecologist, who was the founding director of the Kennedy Institute of Ethics at Georgetown University in Washington.

Potter characterized bioethics as a new discipline devoted to "the *science of survival*," which he saw it as a "bridge" between the two cultures of science and the humanities (Potter 1975, 2299; see also Potter 1971). His vision was to create knowledge that would make possible "a rational but cautious participation in the processes of biological and cultural evolution" (*Ibid*., 2299). The goal of this discipline was "not only to enrich individual lives but to prolong the survival of the human species in an acceptable form of society" (*Ibid*., 67) As an oncologist working at one of the most environmentally-minded universities in the world, Potter viewed human and environmental health as deeply entwined. He was an expansive, secular-minded thinker, whose vision of bioethics was global in scope. His last book, *Global Bioethics*, was subtitled, "Building on the Leopold Legacy," in homage to the great environmental thinker, Aldo Leopold, his colleague at the University of Wisconsin (though apparently they never met). While there is controversy about whether Potter regarded nature as intrinsically valuable or merely instrumentally valuable, there is no question about the breadth and expansiveness of his vision for bioethics.[1]

[1] For discussion of various views about the value of nature see Dale Jamieson, *Ethics and the Environment* (Cambridge: Cambridge University Press, 2008), chapters 3 and 6. For more on Potter's legacy, see with

André E. Hellegers was a Catholic obstetrician-gynecologist who founded an institute in a Jesuit university that was initially devoted to the study of human reproduction and development. He came to the attention of the Kennedy family through his work on the Pontifical Commission for the Studies on Family, Population and Birth, created by Pope John XXIII during the time of the Second Vatican Council, and expanded by his successor Pope Paul VI. Although within the church Hellegers was regarded as a liberal, the institute he founded was guided by a Catholic moral agenda, primarily focusing on questions of reproductive ethics, and justice in the provision of health care. The "Georgetown model" (as it came to be called) introduced a notion of bioethics focused on concrete medical dilemmas, primarily in three fields: (1) the rights and duties of patients and health professionals; (2) the rights and duties of research subjects and researchers; and (3) the formulation of public policy guidelines for clinical care and biomedical research (Walters and Beauchamp 1978, 1).

Whereas Potter saw bioethics as a new discipline that would combine scientific and philosophical knowledge, Georgetown saw bioethics as part of an old discipline, philosophy—in particular, as a branch of applied ethics (Potter 1975, 2297; Beauchamp and Walters 1978, 49). Potter was convinced of the potentially strong and influential links between science and ethics, but the Georgetown model emphasized the autonomy of ethics and its independence from science (Potter 1971, 49-53; Beauchamp and Walters 1978, 1). While Potter called for broad, new thinking about the human condition, the Georgetown model sought to "resolve [concrete] moral problems" in the biomedical arena, through the coherent application of already-established and universally valid

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Peter J. *Whitehouse* "Van Rensselaer Potter: An Intellectual Memoir," *Cambridge Quarterly of Healthcare Ethics* 11 (2002), pp. 331–334 ethical principles (Reich 1995, 21, referencing Beauchamp and Walters 1978, 33).

Potter was a loner in this field, and his periodic publications could not compete with the Kennedy Institute in influence. In contrast, Hellegers benefited from his base at the Kennedy Institute, an endowment provided by the family, a supportive university setting, and a coherent intellectual agenda, As a result, Helligers' conception of bioethics quickly became dominant. A similar vision of bioethics was also embodied by the Hastings Institute, founded in 1969 by Catholic philosopher Daniel Callahan and psychiatrist Will Gaylin. The Georgetown model was encapsulated in the 1978 *Encyclopedia of Bioethics*, which Callahan has called "the central document" that gives bioethics "a sense of coherence and direction," serving as a "rallying point" for all who work in the field (as quoted in Reich 1994, 330).

In the decades since, the Georgetown model has become even more dominant, thanks in part to financial and institutional incentives that favor clinical and research ethics over other kinds of health and environmental ethics. Bioethicists who work on clinical and research ethics are able to work in universities, medical schools, and hospitals that provide ethical education, consultation, and oversight for practitioners. In contrast, while bioethicists who work on other kinds of health and environmental ethics are able to work at universities, they do not have much presence in medical schools nor an analog to hospitals where they can provide ethical education, consultation, and oversight for practitioners. Given this difference, it makes sense that bioethics programs, faculty, and students would focus more on clinical and research ethics and less on other kinds of health and environmental ethics, so that the supply of bioethicists can meet the demand. However, an unfortunate consequence of this trend is that some of the most important health and environmental issues that we now face, including the structural health and environmental impacts of food, war, and climate change, are relatively neglected within bioethics.

Clinical and research ethics are clearly an important part of bioethics. And if there is a market for people who work on these topics, then we should by all means be training people to meet that demand. At the same time, we should be wary about allowing market forces, together with other contingent features of the history of a field, to play too strong a role in shaping the nature of that field. In this case, that means recovering Potter's conception of a broad bioethics. We need to expand the scope of the topics we discuss, the methodologies with which we discuss them, and the communities with whom we discuss them, so that we can address the full range of health and environmental issues we now face in an integrated way.

3. The Contemporary Landscape

Times are changing, and the broader vision of Potter is gaining ground even though he himself remains relatively unknown. The New York University Center for Bioethics, for example, launched in 2007, "promotes a broad conception of Bioethics encompassing both medical and environmental ethics."[2] In 2016, Daniel Callahan, one of the founders of the Hastings Institute, published a book very much in the tradition of broad bioethics.

[2] http://bioethics.as.nyu.edu/page/aboutus. See also Jameton and Pierce 2004.

Interestingly, the tide may have begun to turn first in Italy. In his "Global Bioethics Final Message," an email to the Global Bioethics Network written just before his death in 2001, Potter wrote:

> It was in 1988 that I published *Global Bioethics, Building on the Leopold Legacy*. In all the world there was just one person who saw the book, saw the opportunity and contacted me. It was Brunetto Chiarelli, Professor of Anthropology, University of Florence, Italy. In 1990 he invited me to give a lecture "Global Bioethics" in Northern Italy, in Trentino, a progressive community. I accepted the invitation and went there under the care of my son, Carl. It was my last trip outside the USA (Jamieson 2010).

The idea of broad bioethics is gaining currency because many of the most serious problems we face occur at the nexus of biology, technology, and power. Science and technology have given us the ability to prolong life to such an extent that in particular cases we must decide whether to use this power in light of concerns about the quality of the life that is being prolonged and the investment of fungible resources that would be required to do so. The invention and development of chlorofluorocarbons made access to refrigeration available on a mass scale, but these chemicals have also depleted the ozone layer that makes life on earth possible. As a result, we have had to decide how and when to retire these chemicals, and who is allowed to use them while substitutes are being brought on line.

Some of these problems at the nexus of biology, technology, and power concern clinical and research ethics. These include problems involved with death and dying and the increasing prevalence of obesity. Other problems in this area concern other issues in health ethics. These include problems involved with access to health care and the public health impacts of modern technology and economic inequality. Other problems in this area concern environmental ethics, such as ozone depletion, species extinction, and resource degradation. There are clear cases on both sides of the divide, but even these clear cases carry echoes from the other domain.

Consider the problem of obesity, which poses clear questions of health ethics but also raises questions of environmental ethics. In the United States agricultural subsidies and trade restrictions result in the overproduction of corn, much of which is processed into high-fructose corn syrup, which is then used to sweeten a vast array of manufactured food products, increasing their caloric content, thus contributing to obesity. Other environmental factors such as the nature of the built environment, the geographical shape and structure of cities, and transportation planning also affect the prevalence of obesity. There is a clear correlation between urban sprawl and obesity, though it is controversial as to whether there is a causal connection (Ewing et al 2006; Eid et al 2008).

Now consider ozone depletion, which poses clear questions of environmental ethics but also raises questions of health ethics. As the ozone layer thins, the protective filter provided by the atmosphere is progressively reduced. Consequently human beings and the environment are exposed to higher ultra-violet (UV) radiation levels, and especially higher UVB levels that have the greatest impact on human health, animals, marine organisms and plant life. According to the World Health Organization a 10% decrease in stratospheric ozone is estimated to cause an additional 4,500 melanoma and

300,000 non-melanoma skin cancers and between 1.6 and 1.75 million cases of cataracts each year.[3]

Some problems straddle the health / environment divide. For example, air and water pollution are paradigmatic environmental problems, but they have equal claim to being health problems. Indeed, when governments act on these problems they are usually motivated by human health concerns, though such actions also produce broad environmental benefits. According to a recent study, the number of people dying globally as a result of air pollution may exceed the number killed by smoking. As many as 8.8 million deaths per year globally (790,000 in Europe) can be attributed to air pollution (Lelieveld et al 2019).

In addition to the fact that health and environmental problems often echo in the other domain and that some problems straddle both domains, there are other problems that are arbitrarily assigned to one domain or the other. For example, when genetic engineering is applied to *Homo sapiens* it is regarded as provoking questions of medical ethics. When it is applied to other animals it is viewed as raising issues of environmental ethics. It might be that we can learn from both framings, and that we can see genetic engineering as raising individual and structural health and environmental issues across species.

In our view, the idea of broad bioethics means several things. First, it means that we expand the scope of bioethics to include all health and environmental problems, especially the ones that are most urgently in need of attention. Second, it means that we consider the health and environmental impacts of these problems together, rather than

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[3] http://www.who.int/uv/uv_and_health/en/index.html

only considering one or the other. Third, it means that we discuss these issues not only with each other, and not only with scholars in other fields, but also with advocates and policy-makers. Both inside and outside of the academy, we need rigorous, systematic, and accessible examinations of the health and environmental issues we face, and bioethicists are well-positioned to contribute to this work.

4. Food

Some problems are so complex and dynamic that they exhibit all of these features at once. Consider the impacts of industrial animal agriculture. We currently breed, raise, and kill more than 100 billion animals each year for food,[4] and that number will continue to rise as global demand for meat increases and the rest of the world continues to adopt western industrial agricultural models.

Some of the impacts of our food system primarily concern health but also have implications for the environment. For example, many farmers use antimicrobials on farm animals to make them grow faster and prop up their weakened immune systems (World Health Organization 2014a). But this massive, nontherapeutic use of antimicrobials makes it easy for antimicrobial resistant pathogens to develop. And, when these pathogens do develop, our intensive confinement of farmed animals makes it easy for them to spread among farmed animals (Saenz et al). And, when these pathogens spread among farmed animals, our global distribution of animal products makes it easy for them to spread among consumers as well. The upshot is that we are all at increased risk not

[4] This estimate is based on FAOSTAT data, available at http://faostat3.fao.org/faostat-gateway/go/to/home/E

only of eating contaminated food but also of contracting infectious disease. And, insofar as new, antimicrobial resistant pathogens pose a risk for other animals (therefore also posing a risk for the ecosystems that these animals inhabit), this health problem is an environmental problem as well.

Other impacts of our food system primarily concern the environment but also have implications for health. For instance, we consume large quantities of natural resources to produce animal products. Consider water and land: We use about 80% of freshwater in the US for agriculture)[5] and a quarter of the ice-free terrestrial surface of the planet for livestock grazing (Steinfeld et al 2006). Now consider energy: We consume an average of three units of fossil fuel energy for each unit of food energy that we produce in the US, and that ratio can rise as high as 35:1 for industrial meat (The Pew Commission on Industrial Farm Animal Production 2008, 29). We also consume a lot of edible energy in the conversion from feed to flesh, milk, and eggs: For example, pigs have a feed conversion ratio of about 3:1 (Schlottmann and Sebo 2018, 72). And of course, insofar as our use of natural resources in industrial agriculture diverts them from other, more efficient uses (such as providing food and energy to a wider population than we currently do), this environmental problem is a health problem as well.

Still other impacts of our food system straddle health and the environment. Waste from factory farms contaminates local air, soil, and water, causing health impacts such as respiratory disease (Merchant et al 2005), neurological problems (Cole et al 2000), and mental health problems (Schiffman 1995) as well as environmental impacts including soil and sediment erosion (Steinfeld et al 2006) and "dead zones" in inland and marine water

[5] https://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/

(Cook 1998). These problems disproportionately affect vulnerable humans, including factory farm workers and local community members. And the impacts of waste have only increased with deregulation. For instance, a few years after the North Carolina State Legislature deregulated hog farms, Smithfield spilled more than twenty million gallons of pig feces into the New River, causing untold damage to public health and the environment. And while Smithfield did pay a $12.6 million fine in this case, this fine is reportedly the equivalent of what they earn every 10 hours (Foer 2010, 178).

Another impact of our food system that straddles health and the environment is the widespread use of synthetic fertilizers and pesticides on crops, as well as the widespread use of genetically modified organisms (GMOs) designed to be resilient in the face of changing soil and weather conditions. We still have much to learn about the effects of GMOs, and some concerns that people have about them, for example that they are unnatural, are overblown. Still, widespread use of corporate-controlled GMOs in monocultures raises questions not only about health ethics and environmental ethics, but also about food safety, security, and sovereignty.[6] These concerns apply to animals too. For example, genetically modified fish routinely escape from fish farms and enter wild populations, raising questions about how they will affect aquatic food chains and ecosystems (Oke et al 2013). At the very least, these are issues to which we should be applying the kinds of risk analyses that are common in health and environmental ethics.

By far the most important health and environmental impact of our food system, however, is its contribution to climate change. We acquire most of the land that we use for agriculture through deforestation, and deforestation destroys not only many species

[6] See World Health Organization (2014b) for a good summary of the ethical questions posed by GMOS as well as for an optimistic view about the health and environmental impacts of properly regulated GMOs.

and ecosystems but also many carbon sinks, thereby releasing carbon into the atmosphere and making the planet less able to absorb future emissions (Stern 2007). Moreover, and more generally, industrial animal agriculture is responsible for a large proportion of human-caused climate change. In particular, it is responsible for an estimated 9% of carbon emissions, 37% of methane emissions, and 65% of nitrous oxide emissions. When we add these contributions together, we find that industrial animal agriculture is responsible for an estimated 14.5% of human-caused greenhouse gas emissions on a 100-year time scale (Steinfeld 2006, xxi). This percentage increases on shorter timescales, due to the increased short-term importance of methane and nitrous oxide.

Finally, of course, we might also regard the animal welfare impacts of industrial animal agriculture as a matter of bioethical concern – though, as we have seen, it is unclear whether bioethicists would prefer to think about this issue through the lens of health ethics, environmental ethics, or both.

In response to these issues, many people are now advocating for, and investing in, alternatives to industrial animal agriculture (Sebo 2018).[7] This includes traditional alternatives, such as industrial plant agriculture and non-industrial animal agriculture. But it is unclear that these alternatives will be able to feed the world in a sustainable way, at least in the short term. In particular, non-industrial animal agriculture would produce the kind of food that people want to eat, but it would not produce enough meat, dairy, eggs, and so on for everyone, nor would it produce these products in an affordable or efficient manner. In contrast, industrial plant agriculture would produce enough pulses, fruits, vegetables, and so on to feed everyone in an affordable and efficient manner, but it would

[7] The next two paragraphs draw heavily from this paper.

not produce the kind of food that people want to eat (or at least it is not clear that it would do so). Thus, while it might be that a plant-based food system should be our destination, it is not clear whether and to what degree it can also be our path toward that destination.

Alternatives to industrial animal agriculture also include products such as plant-based meat (i.e., meat that derives plants) and cell-based meat (i.e., meat that comes from a cell culture). Plant-based meats have existed for centuries (Shurtleff and Aoyagi 2014), and they are becoming increasingly popular all over the world. In contrast, cell-based meat is still in development, and has major political, economic, and technical obstacles to overcome. If it overcomes these obstacles, it can join plant-based meat in providing people with the kind of food that they want to eat in a relatively affordable and efficient manner. But while these products are affordable and efficient relative to conventional animal agriculture, they are not affordable and efficient relative to conventional plant agriculture. Thus, while plant-based or cell-based meat may be on the path towards a better food system, it is not clear whether and to what degree they would also be part of the ideal food system.

Bioethicists have discussed the impacts of our global food system on public health and the environment, as well as some of the ethical questions that these impacts raise, e.g., about the ethics of eating meat.[8] However, they have not yet discussed some of the other ethical questions that these impacts raise. For example, we need to consider: What other food systems are available to us, and what are the expected health environmental impacts of these food systems? If there are tradeoffs between these impacts (e.g., a food system with better health than environmental impacts, or vice versa) or between these

[8] For example, see discussion and references in Jamieson 2008.

impacts and other impacts (e.g., a food system with better health and environmental impacts but worse animal welfare impacts, or vice versa), how should we think about these tradeoffs? Moreover, what are the ethics of individual and institutional action with respect to these issues? For example, if a private or public organization implements a vegan food policy, is this ethically good, since it supports healthful and sustainable food systems, or is it ethically bad, since it limits the freedom of group members?

5. War

Some problems have enormous health and environmental consequences yet have been neglected in both areas. Although it has been clear that war poses both medical and environmental problems since at least 146 BCE when the Romans salted the fields around Carthage to impair food production, war is not typically viewed as posing problems of bioethical concern.

The American war in Southeast Asia (1959-1975) provides many examples of the interlocking environmental and health effects of military tactics. According to one review article, the American strategy in Vietnam involved

> …truly massive rural area bombing, chemical and mechanical forest destruction, large-scale crop destruction, destruction of food stores, the destruction of hospitals, and large-scale population displacements--in short the massive, intentional disruption of both the natural and human ecologies of the region. (Westing 1983, 369)

The best known of these tactics involved the use of various herbicides as defoliants. The most widely used defoliant was Agent Orange, so named because of the color of the striping on the barrels in which it was shipped. Agent Orange was a mixture of two phenoxyl herbicides, and at the time it was used in Vietnam it contained a dioxin (TCDD) as a byproduct of its manufacture. TCDD is a known human carcinogen, frequently associated with soft-tissue sarcoma, non-Hodgkin's lymphoma, Hodgkin's disease, and chronic lymphocytic leukemia, and linked to other diseases and disorders including Parkinson's, heart disease, and high blood pressure.

The Vietnamese Ministry of Foreign Affairs claims that 4.8 million Vietnamese people were exposed to Agent Orange, resulting in 400,000 deaths and disabilities, and 500,000 children born with birth defects.[9] In 1979 a class action suit was filed on behalf of American veterans exposed to Agent Orange against the chemical companies that manufactured it. The companies settled the suit out of court in 1984, creating a compensation fund while not admitting responsibility. The same year the US government passed a law recognizing Agent Orange-related disability claims. Vietnam war veterans from Australia, Canada, New Zealand, and South Korea have also won their struggles to be compensated for Agent Orange-related harms. The only population that has not won its struggle is the one that was most affected: the people of Vietnam. In 2004 a case brought by the Vietnamese association of victims of Agent Orange/Dioxin was thrown out of US Federal Court on the grounds that Agent Orange was not considered a poison under international law at the time of its use, that the US was not prohibited from using it as an herbicide, and that the companies which produced it were not liable for the method

[9] As reported here: http://www.theglobeandmail.com/archives/article697346.ece

of its use by the government.[10]

Unfortunately, very little seems to have been learned from these events. For example, consider some of the impacts of recent US military action in Iraq and Afghanistan. According to the Center for Constitutional Rights (CCR), the US military used white phosphorous, an incendiary chemical agent, in several battles in Iraq, despite the fact that part of the rationale for the US-led invasion of Iraq in 2003 was that Saddam Hussein used white phosphorous against the Kurds in 1991 (CCR 2014, 18).[11] The use of white phosphorous in Iraq is believed to have caused many civilians to suffer from "thermal and chemical burns, respiratory damage, circulatory shock, asphyxiation, and carbon monoxide poisoning," with possible intergenerational effects as well (Human Rights Watch and Harvard Law School's International Human Rights Clinic 2011). Additionally, the US reportedly dropped tens of thousands of cluster bombs in Iraq and Afghanistan and an unknown number of Mark-77 bombs – a functional equivalent of Napalm – in Iraq. Both weapons, like white phosphorous, have a broad range and are reportedly responsible for many civilian casualties. Meanwhile, unexploded cluster submunitions will continue to pose a threat to human and nonhuman populations in the region for years to come (CCR 2014, 20-2).

The CCR also reports that the US military used "between 440,000 kg and 1,000-2,000 metric tons" of depleted uranium (DU) in munitions and armor plating during the war in Iraq (*Ibid*., 22). DU is a synthetic radioactive metal that poses severe health and environmental risks. In particular, "DU can result in harm to the health of humans in four

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[10] For more on this topic, see Galston (2001). However, a recent federal court case has raised the hopes of Vietnamese people affected by Agent Orange; see https://vietnamnews.vn/society/464566/monsanto-court-ruling-bolsters-the-hope-for-millions-of-vietnamese-agent-orange-victims.html#g5WR8H618OpxxlB3.97
[11] The next two paragraphs draw heavily from this report.

ways, i.e. as (1) a toxic heavy metal; (2) a genotoxic (carcinogenic and mutagenic) agent from its chemical properties; (3) a genotoxic agent from its radiation; and (4) an endocrine disruptor" (*Ibid*., 23) To make matters worse, the US military used open air burn pits to dispose of most of its solid waste in Iraq and Afghanistan, exposing military and civilian populations alike to multiple chemicals known to cause "cancers, liver toxicity and reduced liver function, kidney toxicity and reduced kidney function, respiratory toxicity and morbidity, neurological effects, … and reproductive toxicity" (*Ibid*., 26). And while there is currently no consensus about the exact role that burn pits played in increased cancer rates in the region, several independent studies have connected exposure to burn pits with increased constrictive bronchitis, respiratory problems, and cardiovascular problems. Collected anecdotal reports from veterans point to other, more severe symptoms as well (*Ibid*., 27).

Now consider some of the environmental impacts of US military action in Iraq and Afghanistan. As the Watson Institute for International Studies at Brown University revealed in a 2011 report on the Costs of War (Brown University Watson Institute for International Studies 2011), many of the chemicals used during these wars contaminated the soil and water, including depleted uranium, perchlorate (from rocket propellant), and benzene and trichloroethylene (from air base operations). This contamination is believed to have affected not only cancer and infant mortality rates but also the ratio of male to female birth rates in the region (Busby et al 2010, 7). Moreover, the US military consumed an alarming amount of fuel and produced an alarming amount of greenhouse gases during these wars. For example, in a single month in Iraq, the US military is estimated to have consumed over a million gallons of fuel (Associated Press 2008), as much as two thirds of which was used to transport fuel to other vehicles (Conover et al 2004).

The wars in Iraq and Afghanistan have also impacted the environment through the destruction of forests, wetlands, and wildlife. US military action in Afghanistan produced millions of refugees, who, along with US-supported warlords, engaged in widespread illegal logging in order to obtain food, fuel, and other materials. This logging then led to deforestation, which led to aridity, which – along with heavy military vehicles – caused toxic dust to spread much more easily than it otherwise might have (Enzler 2006). Deforestation and bombing have also disrupted migratory routes for animals. For instance, the number of pelicans and endangered Siberian cranes who survived their migration through eastern Afghanistan reportedly fell by 85 percent in 2002 alone (Smith 2002). Finally, the wars in Iraq and Afghanistan have endangered animals in other ways as well: for example, occupying soldiers and aid workers provide a lucrative market for the skins of endangered animals like the Snow Leopard, which has motivated Afghans to hunt these animals to the brink of extinction despite a hunting ban in place since 2002 (Reuters 2008).

It is hardly surprising that war should cause health and environmental problems, especially in view of the truism that the purpose of an army is to kill people and break things. However, it is useful to remember that even preparing for war is destructive. War preparations alone utilize up to 15 million square kilometers of land, account for 6% of all raw material consumption, and produce as much as 10% of global carbon emissions annually (Machlis and Hanson 2008). In the 1990s German military activities accounted for 4.3% of Germany's total CO_2 emissions, while US military emissions were 42% of the US federal government's total emissions, making the military the single largest public greenhouse gas emitter in the US (Michaelowa and Koch 2001). Moreover, the production of weapons containing toxic chemicals has many of the same impacts as their use. For example, a 2009 study estimated that 4.8 tons of depleted uranium leaked from a weapons factory in Colonie, NY and contaminated soil throughout the area (Lloyd et al 2009). And now, more than twenty years after the plant closed, researchers are finding DU in the urine of residents and workers as well as increased cancer rates in the area (Rose 2007). Finally, the US military is exempt from a wide range of environmental laws including the Endangered Species Act, and regulations protecting migratory birds and marine mammals. From a resource perspective, in 2017 almost 2.2% of global GDP is devoted to military expenditures.[12] If this figure were even halved we could purchase an enormous amount of environmental quality and improved health outcomes.

Some bioethicists have discussed traditional medical ethics questions in the context of war (Gross 2006). However, few if any bioethicists have discussed the structural health and environmental impacts of war, or the moral questions that these impacts raise. For example, we need to consider: What kinds of military engagement are available to us, and what are the expected health and environmental impacts of each kind? If there are tradeoffs between these impacts (e.g., a form of engagement with better health than environmental impacts, or vice versa) or between these impacts and other impacts (e.g., a form of engagement with better health and environmental impacts but worse welfare impacts, in terms of combatant or noncombatant casualties), how should we think about these tradeoffs? Moreover, what do states owe to the victims of military

[12] https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS

activity, not only the people directly impacted but also the people indirectly impacted, over the course of generations? For example, if a state engages in military activity that disrupts local ecosystems, consumes scarce resources, or pollutes the air, land, or water, what does the state owe to future generations in this territory whose health and well-being will be negatively impacted?

6. Climate Change

It is climate change, which as we have seen, many of these other problems feed into, that demonstrates most convincingly the importance of an environmental turn in bioethics. The consequences of climate change are broad, deep, and persistent, and human health problems will be of central importance.

The most recent report of the Intergovernmental Panel on Climate Change shows that climate change will increase the incidence of vector borne diseases such as malaria, put more people at risk for malnutrition due to agricultural declines and loss of fish stocks, cause increases in pulmonary and cardiovascular events due to increases in ground-level ozone, increase the incidence of diarrhea due to drought and water shortages, increase cholera due to higher water temperatures, cause more allergies, and increase deaths and damages due to extreme events.[13] It is difficult to precisely quantify these effects because it is unclear what actions will be taken to mitigate and adapt to climate change, exactly how sensitive climate is to increasing concentrations of greenhouse gases, and what will be the regional effects of changes in global climate.

[13] https://www.ipcc.ch/report/ar5/wg2/

While the sign is clear, the exact impacts are not. However, the World Health Organization has estimated that climate change caused malnutrition, malaria, diarrhea and heat stress will result in cause approximately 250,000 additional deaths per year.[14] Others think that number is too low (Haines and Ebi 2019).

As examples of the sort of events that will become more frequent and extreme we can look to 2005 Hurricane Katrina, which killed nearly 2,000 people and caused nearly $200 billion in damages on the Gulf Coast of the United States, the European heatwave of August, 2003 which killed nearly 40,000 people (Robine et all 2008), and the ongoing drought in the Horn of Africa which has left almost 12 million people food insecure.[15] The point is not that these events were caused by climate change (though perhaps they were), but rather that they are the sorts of events that will become more frequent as a result of climate change.

It is difficult to identify the climate change contributions to such disasters because they are always entwined with social and political conditions. Hurricane Katrina was so devastating in part because of the poverty of the city of New Orleans and the weakness of its public health institutions. While there are disagreements about which social factors played the most important roles in the mortality associated with the 2003 European heatwave (e.g., failures in administration and family care), there is no doubt that such factors were strongly implicated. As the warming to which we are already committed becomes more severe, feedbacks between social and political conditions and climate will

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14 https://apps.who.int/iris/bitstream/handle/10665/134014/9789241507691_eng.pdf;jsessionid=C193901907CE0EB419097514AE74495C?sequence=1

15 https://reliefweb.int/report/ethiopia/horn-africa-region-drought-snapshot-june-2019

intensify. The number of environmental refugees will grow, tensions between countries dependent on common, shrinking water resources will increase, and so on.

These concerns will arise from the expected warming of 1.5-4.5 C over the next century. However, there is also the possibility of the sort of abrupt climate change that has occurred at various times in Earth's history. For example, during the onset of the Younger Dryas, which occurred 12,900-11,600 years before present, temperatures dropped more than 16C, and when the Younger Dryas ended temperatures increased 10C in a single decade. In 2003 the Pentagon commissioned a report on the impacts of abrupt climate change, which concluded:

> Humanity would revert to its norm of constant battles for diminishing resources, which the battles themselves would further reduce even beyond the climatic effects. Once again warfare would define human life.[16]

Climate change is occurring. What is in question is its pace, extremity, and consequences. What is clear is that the poor and vulnerable who have done the least to cause the problem will suffer more than the rich and powerful who have done the most to disrupt climate (Jamieson 2014). Such circumstances pose important questions of bioethics. These include the following:

- How much do we value nature, animals, and people, both generally and in specific acute circumstances?
- How do we allocate resources among them?

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[16] https://eesc.columbia.edu/courses/v1003/readings/Pentagon.pdf. In both its 2010 and 2014 Quadrennial Defense Review (QDR) the Department of Defense formally identified climate change as one of the trends posing security challenges for the future; see www.defense.gov/news/d20090429qdr.pdf and https://archive.defense.gov/pubs/2014_quadrennial_defense_review.pdf The QDR has been replaced by the National Defense Strategy which did not mention climate change in its 2018 report.

- How much should we spend treating an acute condition (e.g., a patient with an infectious disease) as opposed to promoting system health (e.g., climate stability)?
- How do we allocate human resources among them? (e.g., nurses vs. forest guardians)?
- What responses to the drivers of environmental degradation (e.g., population and consumption) permissible or obligatory?

These are not the only questions of relevant to bioethics, but they are some of the most obvious and immediate. As the challenges of climate change unfold, the challenges to bioethics will become more vivid.

7. Concluding Cautionary Remarks

We have been suggesting that since the invention of the word 'bioethics' in 1970, there have been, in the United States at least, two quite different conceptions of its subject matter. The Georgetown model, rooted in Catholic moral theology and relatively narrow in focus, has been dominant, but the more expansive notion associated with Potter is attracting increased attention. What we want to suggest now is that in the late nineteenth and early twentieth centuries, long before the invention of the word 'bioethics', the substantive overlap between ethics, health, and the environment was recognized in the public health movement (also known as the sanitation movement) and in the nascent environmental movement.[17] We illustrate this by discussing an important public controversy that began in the 1920s.[18]

In October 1924 five workers at a Standard Oil refinery in New Jersey went violently insane and then died from a mysterious poison they were making. The poison was tetra ethyl lead (TEL), a gasoline additive discovered by General Motors researchers in 1921 and introduced commercially by the Ethyl Corporation in 1923.[19] When it became widely known that this poison was being added to gasoline, and that other workers had died in similar refineries, a vehement controversy broke out. Several states and the city of New York quickly banned leaded gasoline, and public health scientists, such as Dr. Alice Hamilton of Harvard and Dr. Yandell Henderson of Yale, spoke out against TEL. Henderson presciently observed:

> Breathing day by day of the fine dust from automobiles will produce chronic lead poisoning on a large scale…Perhaps if leaded gasoline kills enough people soon enough to impress the public, we may get from Congress a much needed law and appropriation for control of harmful substances other than foods. But it seems more likely that the conditions will grow worse so gradually and the development of lead poisoning will come on so insidiously ... that leaded gasoline will be in nearly universal use and large numbers of cars will have been sold that can only run on that fuel before the public and the government awaken to the situation.

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[17] For more on this overlap see Gottlieb 2005.

[18] In telling this story we have benefited from Kovarik 2013and Kitman 2000. For a fuller account see Kovarik's doctoral dissertation available at https://drum.lib.umd.edu/bitstream/1903/.../Ethyl.Controversy2.Kovarik.dissertation.pdf

[19] The Ethyl Corporation was created by General Motors, Standard Oil of New Jersey (Exxon), and E. I. Du Pont de Nemours. In 1962 the Ethyl Corporation was sold to the Albemarle Paper Manufacturing Company, which then changed its name to the Ethyl Corporation. Albemarle borrowed $200 million in order to purchase a corporation 13 times its size in what was the largest leveraged buy out up to that time. It is widely believed that the sale was motivated by General Motors' concerns about TEL-related liability.

(The New York Times 1925, 1)

In response to this outcry, the Ethyl Corporation denied that TEL posed a health risk to the public since it is diluted in gasoline, and denounced Henderson as a disgruntled scientist who had tried and failed to get a consulting contract from the company. Ironically, Thomas Midgley, Corporate Vice President, discoverer of TEL and most frequent company spokesman on its behalf had himself suffered from lead poisoning the previous year. He wrote, "I find that my lungs have been affected and that it is necessary to drop all work and get a large supply of fresh air" (as quoted in Kitman 2000).[20]

In response to the controversy, the United States Public Heath Service convened a conference on the risks of TEL, and subsequently appointed an expert committee to study the matter. The Ethyl Corporation agreed to take TEL off the market until the committee's report was submitted. The committee's charge was to examine the health impacts of TEL, not to compare its risks and benefits to those of alternatives. Despite their expertise and prominence, neither Hamilton nor Henderson were appointed to the committee.

In January 1926, the committee issued its report. While calling for more research, the committee concluded that there were "no good grounds for prohibiting the use of Ethyl gasoline" (US Public Health Service 1926). Ethyl officials announced that they had been vindicated and, after agreeing to warning labels on leaded gasoline, began to market it again in 1926. For three generations these warning labels would appear in virtually

[20] Midgley worked under the supervision of Charles Kettering who in turn was supervised by Alfred Sloan. Kettering and Sloan are known today mainly for their good works, especially for their roles in founding New York's Memorial Sloan–Kettering Cancer Center. Midgley later discovered dichlorodifluoromethane (Freon) which is responsible for a large fraction of the ozone depletion that we have experienced.

every gasoline station in America: “Contains lead (tetraethyl) and is to be used as a motor fuel only. Not for cleaning or any other use.” By the late 1930s leaded gasoline dominated the American market and had made great inroads in Europe. By the late 1940s leaded gasoline had become the global standard.

The 1950s brought rising concern about air pollution, as well as evidence of widespread exposure to lead. Studies by Clair Patterson and others showed that atmospheric lead levels were 1000 times the pre-industrial baseline, and that the amount of lead in the blood of most people was orders of magnitude greater than pre-industrial levels (see, e.g., Patterson 1965). Still, the automotive industry resisted all attempts to control pollution. In January 1969, the federal government charged the four major US auto companies and their trade association with conspiracy to delay development and implementation of air pollution control devices. Out of fear that the internal combustion engine itself would be outlawed or restricted, GM president Ed Cole changed course and in early 1970 announced that, beginning in 1974, the company would install catalytic converters on its new cars. Since exposure to lead completely disables catalytic converters, this was a decision to abandon leaded gasoline as well.

The manufacturers of leaded gasoline felt betrayed and continued to resist, but by 1986 leaded gasoline was finally phased out in the United States. However, the manufacturers continued to market their product heavily outside the United States, especially in developing countries. It took another fifteen years before leaded gasoline was effectively phased out in the European Union, and longer still until it was phased out in most of the rest of the world. Today leaded gasoline is only sold in Algeria, Yemen, and Iraq.

From 1927 to 1987 about 68 million young children in the United States had toxic exposures to lead from gasoline, resulting in brain damage, cognitive deficiencies, hypertension, neuropathy and, sometimes death. As many as 5,000 Americans died annually from lead-related heart disease prior to the country's lead phaseout.[21] No wonder Dr. Alice Hamilton, who foresaw these consequences, said to Charles Kettering during the May, 1925 Public Health Service conference on the risks of TEL, "you are nothing but a murderer" (as quoted in Dauvergne 2008, 74).

When we look to the future, there are many issues that may lie at the intersection of health and the environment that should be viewed through the lens of a broad bioethics. One issue that is getting increasing attention in medical ethics concerns the power of large pharmaceutical companies over patient care and on the very nature and structure of health care delivery systems. Similar issues may develop in the environmental domain through the power of the carbon market. The development of biofuels has already put pressure on food availability and security in some parts of the world, and in some cases has led to the loss of native ecosystems. As we become increasingly committed to ever more extreme climate change, interest is growing in directly intervening in the climate system. Early stage research is occurring at major universities such as Harvard, and Bill Gates has been investing his own money in such research for more than a decade. These experiments raise important questions, some of which concern ethical reflection (Jamieson 2013).

Whatever the trajectory of this particular issue, the environmental turn in bioethics represents both a recovery of the history of the field, and a welcome resource in

[21] These facts in this paragraph are taken from Kitman 2000, which in turn are based on the following sources: MMWR Weekly 1988 and EPA 1986.

a world in which both human health and the environment are being compromised on a daily basis by the nexus of power and technology.[22]

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[22] We have benefited from presenting early versions of this material at the launch of NYU’s Center for Bioethics, at a meeting of the International Society for Environmental Ethics, and at a meeting of the Working Papers in Ethics and Moral Psychology series at Mt. Sinai Hospital. We have also benefited from discussions with Leah Todd about the health impacts of war, with William Ruddick about the past and future of bioethics, and with J. Baird Callicott and Peter J. Whitehouse about the role that Potter played in the origins of bioethics. This paper is a revised and expanded version of Dale Jamieson, “The Question of the Environment,” in *Trattato di Biodiritto*, diretto da S. Rodota and P. Zatti, *Ambito e Fonti del Biodiritto*, a cura di S. Rodota and M. Tallacchini. Milano: Giuffre Editore (2010): 37-50. World Health Organization, 2014. “Antimicrobial resistance: global report on surveillance.”

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