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Heeding the call of COVID-19

Response to Commentary on [Wiebers & Feigin](#) on *Covid Crisis*

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Abstract: We are grateful to all of our commentators. They have provided a wide range of valuable perspectives and insights from many fields, revealing a broad interest in the subject matter. Nearly all the commentaries have helped to affirm, refine, expand, amplify, deepen, interpret, elaborate, or apply the messages in the target article. Some have offered critiques and suggestions that help us address certain issues in greater detail, including several points concerning industrialized farming and the wildlife trade. Overall, there is great awareness and strong consensus among commentators that any solution for preventing future pandemics and other related health crises must take into account not only what is best for humans but also what is best for nonhumans and the environment, given the profound interconnectedness of all life.

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Foreword. We have reviewed the 28 wide-ranging commentaries on our target article with great interest and are exceedingly grateful to this wide range of specialists for investing the time and effort to share their diverse and valuable insights about the multiple issues surrounding the COVID-19 pandemic and its implications for humanity (**Wiebers & Feigin 2020**). Our gratitude also to the three commentators with opposing viewpoints; they have inspired us to provide more detailed perspectives on several fundamental topics, including industrialized farming, the wildlife trade and various other aspects of the way forward.

It is particularly encouraging and inspiring that nearly all commentators shared in one form or other the sense that it is time to reflect deeply on what the COVID-19 crisis is

telling us about our role in creating this and other related health crises, about how to avoid future crises, and why it is important to rethink our relationship with other humans, nonhumans and the earth.

Our Response is in two parts. *Part One* (sections 1 – 10) is devoted to summarizing and elaborating the points of agreement among the vast majority (25) of the 28 commentaries. *Part Two* (sections 11 – 13) addresses the three commentaries that argue in support of the status quo.

Part One

1. Wildlife Trade and Factory Farming

There was broad consensus among the commentators that the wildlife trade and factory farming constitute two of the most critical issues that must be confronted in humankind's fight against current and future global health crises as well as in efforts to end human cruelty to animals. **Cao** highlights both these issues in China and around the world, providing valuable context on the difficulties in enforcing laws and regulations in various regions. Cao also emphasizes the extensive animal cruelty involved and recommends additional forms of legal liability in her concluding sentences:

“If human societies continue to ignore the risks and keep behaving recklessly, I would pose the following question: Should governments and the owners of intensive animal farms, wildlife markets and their collaborators not be held legally liable for failing to prohibit, prevent, and terminate the practices that are now known to pose grave and global threats to the health and well-being of human and nonhuman beings alike?”

Eshel echoes the call for sweeping change in these areas:

“A long-term solution for COVID-19 requires fundamentally altering our interactions with livestock, wildlife, and indeed the entire natural world. More limited intervention would be as ineffectual as trying to combat the rise in type II diabetes without addressing diet or inactivity.”

Eshel also provides considerable detail in reply to the typical assertions and arguments of the proponents of industrialized farming. **Greger** emphasizes the historically unprecedented rate of emergence of novel human pathogens from the animal world; referring to factory farms as “flu factories” that create “ideal conditions for infectious diseases,” he cites numerous sources ranging from a recent comprehensive report of the [United Nations Environment Programme \(2020\)](#) to the data from industry groups themselves, such as the American Association of Swine Veterinarians (McMichael 2004). Several other commentators, including **Fox**, **Morand**, **Lee**, and **Figueroa & Duprat**, document the urgent and growing threat of zoonotic diseases from intensive farming, wildlife trafficking, environmental degradation and the human fragmentation of the habitats of other species. Many other empirical sources reflect a broad scientific consensus that zoonotic spillover events are increasing and with them the risk of emerging zoonotic diseases (Walzer 2020, Jones 2008). The United Nations report specifically identifies the top

two drivers of zoonotic disease emergence as (1) increasing demand for animal protein and (2) unsustainable agricultural intensification.

2. Increased Zoonosis

Morand's commentary (further elaborated by Morand & Walther 2020) provides a particularly focused and detailed analysis of the risks from the growing number and accelerating geographic spread of human infectious disease outbreaks. The evidence of a substantial rise in zoonotic diseases related to agriculture intensification is discounted by **Robbins** (further discussed in *Part 2*), on the basis of single report by Smith et al. (2014). That report, however, actually confirms the evidence that there has been a major rise in human infectious diseases and an increase in zoonotic disease outbreaks globally (from 1980 to 2013 in that sample). Smith et al. indicate that the per capita case count -- which decreased over time in their study -- reflects the ability of health authorities to address the sequelae of an outbreak, not the threat presented by the increases in the number of outbreaks themselves. That threat is now abundantly apparent in the lack of effective responses to the current COVID-19 outbreak, even in countries with robust health systems. Moreover, Smith et al. specifically state in their paper that “[w]e suspect *per capita* cases for zoonotic outbreaks may indeed be greater than our findings indicate, but this is not detectable due to a lack of communications infrastructure and public health resources in the nations that suffer most from pathogens spilling over to humans from wildlife.”

Greger further documents the fact that most new zoonoses have been the result of how we raise animals for food. He focuses attention on the calls for a moratorium on new and expanding factory farms for the sake of human health and safety by the world's largest association of public health officials, the [American Public Health Association \(2019\)](#). Greger builds upon our target article's call to end factory farm operations and reorient our diet away from meat and other animal products, citing Willett et al.'s (2019) estimate that eating less meat may save at least ten million human lives annually.

3. One Health

Many important points are raised by **Fox**, who expands upon the rationale for reducing our collective exploitation and consumption of animals and emphasizing a [One Health](#) approach (Bonilla-Aldana et al 2020) to unite public health, veterinary and environmental experts in responding to and preventing zoonotic disease outbreaks. This approach complements and parallels our “All Life” approach, reflecting the fact that all life is interconnected and that what is good for nonhumans and the earth is virtually always in the best interests of humans. Commentators **S. Feigin, Broom, Morand, Lee, Skerratt, Bergstrom, Figueroa & Duprat** and **Fawcett** likewise stress the need for a unified approach to all life, focusing on a One Welfare/One Health approach and the need for advocacy among healthcare professionals to help alter the trajectories of pandemics, antibiotic resistance and climate change. **Fawcett** writes:

“W&F call for us to ‘rethink our relationship with all life on this planet’ -- a call that must be met with meaningful and radical action. In a society predicated on animal use and environmental exploitation, this will require a fundamental change in the

way we eat, how and where we choose to live, and how we spend our time, as well as how our societies are governed.”

Lee agrees with the wisdom of a One Health/One Welfare approach but suggests we need to go further:

“Economic governance is currently elevated far above environmental or health governance. Moreover, environmental or health governance is designed in ways that protect economic governance.”

Morand cites the important global collaborative work of the World Health Association (WHO), the World Organization for Animal Health (OIE) and the Food and Agricultural Association of the United Nations (FAO) around the One Health model. He calls for further collaboration with organizations like the United Nations Environment Program (UNEP) to support the environmental dimension, stressing the overlapping factors of Ecohealth, Planetary Health and Global Health.

Skerratt expands the One Health concept to include the evolving discipline of wildlife health, which endeavors to ensure the health and wellbeing of all wildlife and recognizes the key interdependencies with humans and the environment. Skerratt emphasizes the value of wildlife health systems to all life, with benefits including the prevention of future pandemics for a relatively modest level of investment, but he notes that these systems require support by governments, industry, philanthropy, and communities to ensure their viability. **Broom** points out that “The human attitude that there can be actions for short-term gain without considering the consequences for all life must not continue.” **Figueroa & Duprat** add that human anthropocentrism and egocentrism are the major factors underlying the growing threat of emerging zoonotic diseases.

4. Animal products

Nearly all of our commentators acknowledge the fundamental and urgent need for our species to evolve toward a diet based on reducing or eliminating animal products. Many – including **Eshel, Greger, Anomaly, Fox, Fawcett, Lovell, Bryant, S. Feigin, Macrum, Lee, Kona-Boun, Wehbe & Shackelford** and **Hawkins** – specifically advocate further expansion of plant-based meat alternatives or cultured meat. We fully agree. In our call for humanity to “rapidly evolve to eating other forms of protein that are safer for humans” we would certainly include the full gamut of time-honored plant-derived protein sources as well as the more recently developed plant-based meat, dairy and egg alternatives, including cultured meat.

We agree with **Bryant** that “plant-based and cultured meat present an opportunity for humans to preserve the experience of eating meat without contributing to the moral, environmental, and public health ills associated with animal agriculture.” **Anomaly** focuses on the rapidly evolving technology of cultured meat and its potential role in limiting or ending the “pointless pain that animals on factory farms currently endure and the preventable diseases they spread to human beings.” **Lovell** echoes the value of evolving toward plant-based diets, concurring that “our dependence upon animals for food and other resources is dangerous to public health”. He also calls attention to the substantial risks

involved in various types of farm work (including enhanced risk of contracting COVID-19). There is a clear imperative for society to protect its farmworkers.

5. Is earth a lifeform?

One minor issue of disagreement with **Anomaly** and **Broom** (which may be largely semantic) concerns whether the earth is a lifeform. This has long been a matter of scientific controversy (Kirchner 1989; Kleidon 2004; Lovelock 2007; Doolittle 2019). While we agree that the earth is not sentient (i.e., capable of feeling), as defined in human and nonhuman contexts, it does possess the capacity to self-regulate on a planetary scale. Hence, on some definitions of life it could be argued that this self-regulating capacity warrants considering the earth as a form of life (Macklem & Seely 2010; Eskov et al. 2017; Vitas & Dobovišek 2019). After all, it has served to maintain habitable conditions in the biosphere for the past 3.5 billion years without foresight or planning on the part of humans or other organisms. This global homeostasis that keeps the atmosphere, the oceans, the forests, lakes and other environments functioning properly is so complex and precise that it has even led some to infer an underlying form of terrestrial “intelligence” (Lenton and Latour 2018, Mickey et al. 2020, Kafatos and Nadeau 2000). In any case, we cannot agree with **Anomaly** that we do not owe the earth anything; on the contrary, our own and all other species’ ability to survive and all else we do depends upon the earth and the integrity of its ecological processes, providing us all with abundant plant and animal life as well as clean air and water.

6. Intensive farming

Further evidence that the global risk of zoonotic disease emerges from intensive farming is provided by **Schuck-Paim**, who cites the endemic difficulties and poor compliance with biosecurity measures in the industry. She also raises several important economic issues related to industrial farming including the “need to promote the regulatory and market incentives needed to transition away from industrial animal farming systems and towards the development of globally safer food sources.” This includes divestment from companies that participate in factory farming operations and further investment in advancing technologies for the development of safer food sources that can compete with traditional animal-sourced foods, as advocated by **Bryant** and **Anomaly**. **Schuck-Pain** also counters the frequent assertion of livestock industry advocates that the industry is a propeller of economies:

“[A] more comprehensive analysis shows that many of the claimed benefits are intrinsically linked to market distortions in the form of subsidies, credits, and negative externalities, including loss of natural capital (Schuck-Paim and Winckler 2019), animal suffering at unprecedented levels and the enormous health and financial burden of infectious diseases.”

7. Animal suffering

Many commentators rightly emphasize the animal cruelty inherent in intensive farming, the wildlife trade and live animal markets. **Kona-Boun** contributes a detailed and heavily referenced account of the physical and psychological suffering inflicted upon farmed animals by industrial practices from the perspective of a researcher and practicing veterinary anesthesiologist. As neurologists, we fully agree with **Kona-Boun** that “sentience—the capacity for suffering, physical as well as psychological, in most nonhuman animal species—is no longer in serious dispute” and that

“the behavioral and neural evidence that most animals (including farmed animals except perhaps the simplest invertebrates) are sentient is abundant: the growing number of empirical studies on animal suffering provide an incontrovertible response to anyone who would still question the existence of such.”

We also with agree **Kona-Boun** that “the exploitation of farmed animals is among the main causes of the suffering that human beings inflict upon nonhuman animals”, that “suffering is there throughout all stages of production—breeding, housing, transport, usage and slaughter” and that there is an “inherent contradiction between animal welfare and financial considerations throughout the production process” making it “impossible for the animal production industry to operate without causing psychological and physical suffering to the vast number of animals killed every day.” **S. Feigin** too points out the need for more human empathy and compassion, observing that:

“our perception of being ‘superior’ to non-human animals has given us an excuse to subjugate and use them for our benefit at a cost of unimaginable cruelty and suffering. It does not cost the earth to be kind, but it may cost us the earth if we allow economic interests to override welfare and health concerns.”

Cao and **Whitfort** call attention to the animal-cruelty aspects of factory farming and the wildlife trade in China as well as the absence of adequate animal welfare legislation or enforcement of existing laws. Both commentators also acknowledge that these issues are not unique to China and point to the need for global cooperation in creating and enforcing laws and agreements to enhance animal health and welfare.

8. Antropogenic Damage to the Planet

Hawkins’s very thoughtful and insightful commentary expands upon our target article and urges all of us to situate the COVID-19 crisis within the larger context of what we humans have done to the nonhuman forms of life with which we have evolved. She highlights the grossly unsustainable path on which our species finds itself:

“We humans, collectively, have usurped natural habitat and diminished native species to an astonishing degree, replacing wild animals with domestic livestock, commodifying those that remain, and converting their wild habitats into vast agro-industrial monocultures.....An astounding statistic exposes the existential situation in stark relief: recent estimates (Bar-On et al. 2018) are that the total biomass of all the remaining wild mammals on Earth is equal to no more than about 4% of the biomass of humans plus our domesticated food animals.....Most of the world’s large

animals—its “megafauna”—are being squeezed right out of existence. They are caught between the pincers of habitat encroachment—increasingly for agro-industrial monocultures of crops to feed livestock imprisoned in Concentrated Animal Feeding Operations (CAFOs)—on the one side, and human hunters on the other, scouring remaining habitat, funneling survivors into increasingly lucrative global markets for pets, bushmeat, and animal parts (Machovina et al. 2015; Ripple et al. 2016; Ripple et al. 2019). It is apparently out of this unholy nexus that the COVID crisis was generated.”

Hawkins encapsulates some of the most pertinent anthropogenic drivers of our currently unsustainable situation as follows:

“Our ‘success’ at being able to satisfy a multitude of human ‘preferences’—preferences often induced, and certainly reinforced, by profit-oriented advertising—has led to many of us adopting habits that have us living far, far outside our naturally evolved ecological niche....human agency has been intentionally harnessed into working toward goals like stimulating appetites for salt, fat and animal flesh, reinforcing beliefs attributing an elevated status to meat-eaters, and above all making money while supplying the mass-produced ‘product,’ (and) the result has been, predictably, untold animal suffering with the proliferation of CAFOs around the globe. These are accelerating deforestation in the tropics with increasing hunter penetration of remaining wildlands and hence wild animal distress and destruction, and increasingly hazardous conditions for human health, the present pandemic being only the latest in a growing series of epidemic zoonoses.”

9. Global Legal and Governance Systems

Important insights into our prevailing global legal systems are provided by **Wyatt**, who calls for creating a clear definition of harm to others grounded in earth jurisprudence – one that extends beyond harm to other humans and includes harm to all lifeforms. She emphasizes that simply altering the existing legal system is unlikely to be enough because the environment and animals are mostly defined as property rather than as subjects before the law. In her summary, **Wyatt** states:

“We must recognize that the dominant current system is harmful, because it threatens the survival of ourselves, other beings, and the planet. The legal and criminal justice systems have a sometimes-overlooked role to play in facilitating the changes we make to our actions and relationships. Limiting wildlife trade and markets, ending intensive farming, improving nonhuman animal welfare, and decreasing habitat incursion and destruction will all require a new legal infrastructure.”

Lee calls for changes in global governance institutions, observing that:

“If we wish to shift the goals from wealth generation to stewardship of the planet in sustainable ways then the carrots and sticks embedded within global governance need to change fundamentally. In other words, we have systems of global governance which reward behaviors that are contributing to planetary destruction. The carrots and sticks built into the system do not encourage behaviors that are

sustainable. Change the way rewards and punishments are doled out, and we change our collective fate.”

Bergstrom expands upon the critical need for global cooperation, calling upon the United States to reassume its leadership role in environmental protection and reaffirm the importance of global institutions such as the World Bank and International Finance Corporation. **Bergstrom** acknowledges that in capitalist-democratic societies “our strongest tools for preservation of wild animals and their habitats, and for preventing and ameliorating future zoonoses, include asserting our rights as citizens and voters to insist on strong government and international institutions (CDC, WHO, CITES, etc.) and to exercise our power as consumers to guide responsible practices of land use, habitat protection, and animal welfare.” **Bergstrom** also reminds us of the fundamental importance of education to help citizens exercise their powers of citizenship and consumerism meaningfully.

10. Psychological Factors

Several commentators focus their discussion on various human psychological or psychiatric factors related to the current or other pandemics. **Marcum** raises the question of whether humans could handle the truth about what the COVID-19 crisis is telling us. Although he appears to be in complete agreement with us about the substance of what needs to be done, **Marcum** expresses concern with “animal agriculture’s ability to conceal its mistreatment of animals.” He points out that

“the industry, through its advertising and lobbying conceals and denies its violence (Schally 2018; Fiber-Ostrow and Lovell 2016). The result is that most people consider their intake of meat and other livestock-based products as a right derived from their status as the superior species” (Bogueva and Marinova 2020; Chapman and Huffman 2018).

Marcum concludes with cautious optimism that we, as a species, will be able to “surmount the obstacles to making the imperative changes in our relationship to wild and farmed animals, both for their sake and ours.”

Toates draws attention to the processes that control human behavior, focusing on the differences between what are largely considered to be cortical vs. subcortical functions and emphasizes the need for policies to be informed by an understanding of human brains and evolution. He stresses the need for our species to cultivate more of the cortical, slow, purposive cognitive functions, but also recognizes that the types of sweeping behavioral changes that are needed may best be accomplished by engaging both cortical and subcortical functions in parallel.

Gerlai’s analysis focuses on the relatively unchecked and dominant human mindset of unsustainable economic growth. He points out that “a system without appropriate feedback mechanisms (a negative feedback loop) will go out of control” -- and that “humanity is currently such a system.” He observes that such a mindset is often at odds with the types of altruism, cooperation and long-term perspective that are required to deal with global events now unfolding such as COVID-19.

Wehbe & Shackelford discuss intuitive, affective and moral constructs to awaken individuals and society to the direct or indirect support they are unwittingly providing for

the types of animal abuse inherent in factory farming and live-animal markets. **Marazziti** provides a psychiatric and psychological perspective: “We must exercise our empathy, altruism and innate moral skills, essential for our survival and development, not only toward other members of our own species, but toward all living and nonliving elements of our planet.”

Part Two

11. Defending the Status Quo 1: Consumer Psychology

The foregoing commentaries discussed psychological and psychiatric factors that might help humanity facilitate the types of changes advocated in our target article. In contrast, **Davis et al.** -- although they do advocate computational and cognitive efforts to “someday convince consumers to eat cultured meat” -- devote much of their discussion to ways their psychological strategies could be used to *avoid* changing the status quo. To liken the risk of feeding birds outside one’s home to the risks posed by factory farming, the wildlife trade and live-animal markets is not only far-fetched but it is at odds with the growing consensus in the scientific community. It is to trivialize the risks posed by factory farming and the wildlife trade and imply that better communication and some minor tweaking of these practices is all that is needed to mitigate the risk of future pandemics and related human health crises. This stance is rejected by most of the accompanying commentaries as well as by global public health experts (Walzer 2020, American Public Health Association 2019).

Davis et al. contend that the notion of phasing out animal meat production is unrealistic given “its current capacity to feed the world in a cost-effective and sustainable manner.” But the commentaries of **Hawkins, Eshel, Greger, Fox** and point out that there is nothing sustainable about the global meat industry or industrialized farming. It is an extremely inefficient way to try to feed the world. We could provide food to far more people using far fewer resources by decreasing or eliminating the breeding and feeding of animals for meat. For every 100 calories of cereals fed to animals, just 17-30 calories are delivered to the human food chain as meat (Nellemann 2009, Lundvist 2008). A recent analysis from Oxford University’s [Our World in Data](#) team reports that although animal agriculture (raising and feeding livestock for meat, dairy and eggs) currently uses 77% of agricultural land, it produces only 18% of global calories and 37% of global protein in the world’s food supply (Ritchie and Roser 2019). What appears as if it were a lower cost for meat produced on factory farms is an illusion created by externalizing many of the costs of this type of agriculture to others outside the industry, a topic that we will cover in more detail below in the discussion of the **Robbins’s** commentary.

In some of their prior work, **Davis et al.** have invested time and energy to develop psychological approaches to convince consumers and policy makers of the safety of various types of meat consumption (Tapp et al. 2016; Davis et al. 2020,). This coincides with the approach in their current commentary, which seems to be an attempt to help readers and society rationalize or avoid thinking about the dangers and horrors of industrialized farming, including the staggering scope and degree of farm animal suffering documented by **Kona-Boun** and others (Gregory 2008; Aaltola 2012; Dawkins 2012; Eaton 2018; Morris 2021).

We are saddened to see talent in psychology devoted to these ends and would strongly encourage these very capable colleagues to use their skills in ways that are on the right side of history for our species and for all life on this planet.

12. Defending the Status Quo 2: “Boundaries”

Urbanik agrees that we need dialogue and change in a post-COVID-19 world but she suggests that we are “reinforcing problematic boundary-making mindsets” in suggesting that factory farming and live-animal markets be phased out. Yet her discussion proposes no solutions for preventing future pandemics, focusing instead on various rationales for justifying the status quo on the basis of “human-animal/nature boundaries”, “political-cultural boundaries” and “hierarchical economic boundaries”.

Urbanik objects that we are “going against the ongoing evolutionary interactions that have shaped the planet and human species.” We would suggest that factory farms and live-animal markets, far from representing ongoing evolutionary interactions, are human-generated, highly unnatural and ill-advised practices that are debasing to our species and destructive of all lifeforms involved. This is delineated and documented in most of the accompanying commentaries. **Hawkins** points out that many of our human-generated evolutionary tendencies have led to a biosphere that is grossly out of balance, dangerous and unsustainable and that there is an urgent need to reject these practices rather than to rationalize them.

Urbanik assumes that we advocate phasing out live-animal markets on the basis of “western” or “colonial” mindsets that are condescending to Asians. Yet there is broad global scientific and public-health agreement on the dangers inherent in continuing these practices -- and this agreement extends to all parts of Asia. The Chinese government did not impose a ban on the trade and consumption of wild animals in China in 2020 because of a “western” or “colonial” mindset but to protect its people and the economic and political future of its country. We advocate phasing out these trade and consumption practices in all countries of the world.

Urbanik also suggests that it is improper for us to advocate a ban on live-animal markets and factory farming without advocating a ban on animal research because this would constitute “selective boundary making” among industries. Yet the very reason we are selecting live animal markets and factory farming is the enormous risks they pose of giving rise to the types of pandemics and other health crises described in the target article—risks that are widely agreed upon by nearly all commentators and an overwhelming majority of scientific and public health experts. (United Nations Environment Programme 2020, American Public Health Association 2019). Although there has long been plenty of reason to be critical of the animal research industry (Wiebers et al. 1994), that was not the focus of the target article. A strong case can indeed be made for limiting or discontinuing other industries that use and abuse animals, but none of these industries represents the level of risk posed by current and future pandemics. Hence it would not have made sense to attack all of them in an article concerning pandemic prevention.

We share and appreciate **Urbanik**’s expressed desire to be helpful to animals, but can only regret that her discussion lacks any acknowledgement of the unspeakable scope and depth of animal suffering and cruelty inherent in factory farming and live-animal markets.

13. Defending the Status Quo 3: The Industry's Standpoint

Our policy recommendations are too simple, suggests **Robbins**. The commentaries of **Fawcett, Lee, Morand, Cao, Schuck-Paim, Bryant, Wyatt, Bergstrom, Wehbe & Shackelford, Hawkins** and others suggest otherwise. Robbins's rather surprising claim that the "rate of zoonotic disease" has not been increasing over the past 40 years has already been addressed above, with the help of **Greger, Fox, Morand, Lee, Figueroa & Duprat** and an abundance of other data to the contrary from the medical, veterinary, public health and scientific communities (United Nations Environment Programme 2020, Walzer 2020, Morens et al. 2020, Morand and Walther 2020, Jones 2006, Greger 2006, Epstein et al. 2003).

Pointing out that we do not address counterarguments about the value of industrialized farming, **Robbins** goes on to advance several that (as subsequent commentators **Eshel** and **Schuck-Paim** note) are typical of intensive livestock operation advocates. We do not find any of these arguments valid; all ignore the dangers of these operations to humans, nonhumans and the earth, as well as the unimaginable suffering and cruelty they inflict on more than 70 billion animals annually. **Robbins** extolls the efficiency of factory farming. Yet, on the contrary, as already discussed in this Response, factory farming is in fact an exceedingly inefficient and unsustainable way to try to feed humans on this planet. Robbins notes that "factory farms may be able to prevent and control disease better with fewer environmental impacts than small-scale farming" but the actual evidence overwhelmingly suggests otherwise:

As detailed above, factory farms have created and continue to create (rather than prevent and control) an historically unprecedented emergence of new pathogens, with industrialized farming clearly identified as a dominant and mounting threat to human, nonhuman and environmental health (United Nations Environment Programme 2020, American Public Health Association 2019, Jones et al. 2013, Greger 2006). With regard to environmental impact, a report from Pew Foundation Charitable Trusts and The Johns Hopkins Bloomberg School of Public Health sums up the problem with industrialized farms compared to small farm operations as follows:

"IFAP (industrial food animal production) stands in sharp contrast to the more pastoral animal farming methods it has replaced by virtue of the emphasis placed on producing large numbers of animals in close confinement, as rapidly and as cheaply as possible. Until IFAP, agricultural practice and animal husbandry evolved over more than 10,000 years and proved to be more or less sustainable as measured by the agricultural inputs and outputs and ecosystem health. IFAP systems, on the other hand, are a recent development, dating back approximately 50 years. Rather than seeking a balance between the natural productivity of the land to produce crops to feed animals and absorb wastes produced by those animals, the industrial model concentrates on growing animals as units of protein production. Inputs of feed and feed additives containing antimicrobials ensure that the animals make it to market weight in the shortest period of time possible. Both animals and their waste are concentrated and usually exceed the capacity of the land to produce feed or absorb the waste. Consequently, the rapid ascendance of IFAP has produced an

expanding array of deleterious environmental effects on local and regional water, air, and soil resources” (Pew 2009).

Robbins also calls on us to define what we are referring to as “factory farms,” adding that according to current USDA definitions, over 97% of farms in the United States are “family farms.” The latter very misleading appellation and statistic is based on a definition that includes

“any farm organized as a sole proprietorship, partnership or family corporation. The size of farm or style of operation is not taken into account and a family farm may not even have a family that owns or works the land. On the contrary, family farmers caught up in the industrial food system are likely not to have full ownership or control over managerial decisions but still have the liability associated with pollution and other consequences” (Harvie 2010).

When we designate factory farms, we are referring to all operations that include industrial livestock production practices in which densely populated groups of animals are confined to cages, barns or feedlots. Rather than the animals grazing or foraging, the feed, water and medical inputs are provided to them, with their excrement collected in ponds (called lagoons) or pits, to be sprayed onto nearby fields (FoodPrint 2020). The United States Environmental Protection Agency uses a similar definition based upon industrial methods and the potential to be a significant contributor of pollutants. Based upon these definitions, it is estimated that over 98% of U.S. farmed animals live on factory farms—a reality on the opposite end of the spectrum from the impression that traditional family farms still dominate U.S. agriculture (Zampa 2019). The Food and Agriculture Association of the United Nations defines family farming as “a means of organizing agricultural, forestry, fisheries, pastoral and aquaculture production which is managed and operated by a family and predominantly reliant upon family labor, both women’s and men’s. The family and the farm are linked, coevolve and combine economic, environmental, reproductive, social and cultural functions” (Garner 2015). This type of farm as a producer of farmed animal products has been fading rapidly in the United States in recent decades with increasingly dire consequences for individuals, families and communities throughout rural America.

Robbins claims that factory farms use more antibiotics than family farms only because they are larger, yet common sense and substantial scientific evidence suggest that the massive overcrowding of animals and unsanitary conditions present in factory farms require far more antibiotics per animal to prevent disease and maintain health than animals who are allowed to live in more natural settings (Pew 2009). In addition, factory farm operations have used antibiotics more broadly in their methodologies to enhance and accelerate animal growth.

Robbins writes about factory farms having great potential for implementing risk mitigation strategies, including biosecurity measures and environmentally responsible policies -- but the reality over the past 40-50 years during which factory farming has become the dominant form of farming in the United States is that poor compliance with biosecurity and environmental measures has been endemic within the industry. This is based in part on the motivation for profit which appears to overwhelm other motivations in this industry. Another important factor is described in a recent Foodprint report as follows:

“Because CAFOs [“Concentrated Animal Feeding Operations”] are classified as ‘agricultural’ and not ‘industrial,’ despite the massive scale of their operations, they

are not subject to the appropriate level of regulation that their size and the amount of pollution they produce really warrant. The industry has been able to block, undercut and shape laws and regulations that should protect the public from the environmental, public health and economic consequences of CAFOs; as such, most of these policies instead favor the industry heavily” (FoodPrint 2020).

The bottom line with all these industry counterarguments is that over the past 40-50 years none of them has prevented the continually increasing and now alarming degree of risk to human health that we are facing from industrial farming methodologies, not only from pandemic risk, but also from antibiotic-resistant infections and other zoonoses; grossly unsustainable and ever-increasing air, water and soil pollution; deforestation and habitat destruction—and none has prevented the unconscionable suffering at all stages of production of the 70 billion animals on which they are now inflicted annually.

Robbins also refers to “other pervasive forms of human-animal contact” such as pet ownership, zoos, county fairs etc. and suggests that these may need to be banned or heavily restricted. These activities do not pose anywhere near the risk of future pandemics and do not involve the enormous amount of environmental destruction and unnecessary suffering and death in nonhumans and humans as we have delineated above. This type of argument has often been used to justify various forms of animal use and abuse for economic gain, meant to distract from the destructive aspects of the economic activities and to frighten people into thinking that other kinds of human-animal interactions may be taken away from them.

Robbins suggests that we have not considered the “tradeoffs and unintended consequences” of our policy prescriptions. On the contrary, we have: discontinuing factory farming would result in a cleaner and more sustainable world, better lives for animals and healthier human beings. He questions why we say that China’s shutting down its wildlife farming industry had benefits which outweighed the \$74 billion costs. Looking at the COVID-19 pandemic alone (without even considering future pandemics or the many other detrimental effects of this industry as delineated above), we have thus far experienced 2.5 million human deaths in a little over a year and tens of millions of survivors with potentially permanent damage to various parts of the body including the lungs, kidneys, brain and cardiovascular system. Over the first 4 months of the pandemic, financial damages were conservatively estimated at approximately \$11.5 trillion which would extrapolate to somewhere around \$30-40 trillion now (Dobson 2020 ref). The unnecessary death and disability cited above (and all of the associated suffering and destruction) are beyond elements that can be expressed in terms of money and should, in themselves, outweigh monetary considerations even among industries that are heavily motivated by profits. This aspect, combined with the estimated economic damage related to this single pandemic thus far, which is several hundred years’ worth of the estimated value of the Chinese wildlife farming industry, should leave little question as to the comparative benefits and risks of shutting down this industry vs. continuing along our same trajectory.

In his concluding remarks, **Robbins** suggests that our policy suggestions will involve, the “elimination of people’s livelihoods and longstanding cultural traditions” and “radical lifestyle changes”, yet he fails to mention that the large majority of people’s livelihoods that have been eliminated are those of the true family farmers who are getting closer and closer to extinction as a result of industrialized farming. Independent farming is no longer a viable

livelihood and concentrating industrial production among a few big companies diverts profits from farming away from farmers, farm families and farm communities and into the hands of faraway investors, aggravating the economic, geographic and political divides in the United States and elsewhere. (Semuels 2019, McGreal 2019). We disagree that discontinuing factory farming would involve the elimination of “longstanding cultural traditions”. On the contrary, the longstanding cultural tradition in this realm is more akin to the picturesque, wholesome, naturally sustainable, modestly prosperous family farm (as was a common site in the countryside 50 years ago) than it is to massive industrial farming structures where farmers have been relegated to serve as factory workers for large corporate entities. In this scenario, the farmer has little or no control over operations and yet, in many cases bears the liability for various forms of pollution and other detrimental effects occurring on their land. For those who had been involved with the actual longstanding cultural tradition of family farming, it has been the worst crisis in decades, with skyrocketing bankruptcies and loss of incomes and livelihoods. Over time, this has taken wealth, power, viability and economic opportunity away from entire communities (Semuels 2019, McGreal 2019).

In terms of the “radical lifestyle changes” that **Robbins** references, we are grateful that a growing range and number of individuals are coming to recognize that, as discussed above, our current trajectory in how we farm and how we feed our population on this planet is grossly unsustainable. Reducing or eliminating factory farms is only a radical idea to those who either profit from them or do not understand their implications for our collective future on this planet. The so-called economic efficiencies of these operations and superficially cheaper cost of meat that factory farm advocates espouse rely on externalized costs and hence do not reflect the actual costs of producing such meat. Our economics has become very distorted in this realm such that the price of industrially produced animal products reflects some of the costs such as housing and feeding animals but does not reflect the costs of government subsidies and adverse impacts on natural resources and human and animal health including massive amounts of water, soil and air pollution; soil degradation and habitat destruction; biodiversity loss; increased levels of disease in humans and animals from various forms of pollution, zoonoses and dietary considerations; and unimaginable amounts of suffering in industrialized farm animals. These adverse impacts continue to mount over time and the costs are generally passed along to taxpayers, governments, societies and future generations. In some cases, the costs are not borne by anyone and vital natural resources such as soil, water and biodiversity are allowed to deteriorate, which undermines the ability of future generations to stay healthy and feed themselves. Many of these adverse impacts will not be correctable, but the costs associated with the ones that can be corrected (or at least partially accounted for) amount to many trillions of dollars per year on a global scale (Springmann 2016, Schader 2015).

Regarding the food we eat, not only does raising the vast majority of our farm animals on factory farms increase the risk of future pandemics, antibiotic-resistant infections and other zoonoses, but having our diets consist so heavily of animal products also increases the risk of human starvation (as above, we could feed many more of the 1 billion or so underfed people in the world with a more plant-based approach). Increased also are the risks of many noncommunicable diseases and disorders such as cardiovascular disease, diabetes mellitus, obesity, ischemic stroke, Alzheimer’s disease and many forms of cancer. The FAO has estimated that under our current trajectory, the production of animal products would have to double by 2050 to meet world demand: but there is literally no way meet that volume of

nutritional demand without converting the large majority of earth's remaining forests and shrubland into land devoted solely to producing meat, dairy and eggs – unless we change our diets away from farm animal products. A recent University of Oxford study analyzed and valued the health and climate change benefits of dietary change and concluded that a transition toward more plant-based diets that are in line with standard dietary guidelines could avoid 5.1 million avoided human deaths per year and reduce food-related greenhouse gases by 29-70% by 2050. Moving to totally plant-based diets could result in 8.1 million avoided deaths per year and even greater greenhouse gas benefits. The economic value of moving to a plant-based diet -- including both human health and environmental benefits using a value-of-life benefits approach -- was calculated to be as high as \$31 trillion per year or 13% of global GDP by 2050 (Springman et al. 2016).

Afterword. As the true cost, danger, unsustainability and inhumanity of attempting to feed ourselves and the world with industrially produced food animals has become more apparent, there has been a corresponding outpouring of interest in developing divergent sources of protein (Rzymiski et al. 2021), not only among start-up entrepreneurial enterprises but also among major meat producers who can likewise see the writing on the wall (Tubb & Seba 2021). It is encouraging and necessary that great change is occurring in this arena. We will need to perpetuate and expand it for the sake of humans, nonhumans and the earth.

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