COMPENSATION AND LIMITS ON HARM IN ANIMAL RESEARCH

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ABSTRACT

Although researchers generally take great care to ensure that human subjects do not suffer very serious harms from their involvement in research, the situation is different for nonhuman animal subjects. Significant progress has been made in reducing unnecessary animal suffering in research, yet researchers still inflict severe pain and distress on tens of thousands of animals every year for scientific purposes. Some bioethicists, scientists, and animal welfare advocates argue for placing an upper limit on the suffering researchers may impose on animal subjects, with rare exceptions for research that promises critical social benefits. In this article, I argue against such an upper limit on harm on the grounds that researchers often can compensate animal subjects for their suffering, even severe and long-lasting suffering. If animal subjects receive adequate compensation for the harms they suffer, then there is no general limit on how much suffering researchers may impose on them for scientific purposes.

Scientists and oversight officials generally take great care to ensure that human subjects do not suffer very serious harms from their involvement in research. The rare cases in which researchers cause human subjects to suffer severely or die prematurely have led to public controversy and the termination of studies or entire research programs (Steinbrook 2008). The situation is different, however, for research with nonhuman animal subjects. Although researchers and oversight officials strive to protect animal subjects from avoidable suffering, animals often experience severe pain and distress (usually followed by euthanasia) for scientific purposes (Carbone 2011). Some bioethicists, scientists, and animal welfare advocates maintain that, like with human subjects, it is generally unethical to impose very serious harms on animals in research. They argue for placing an upper limit on the suffering researchers may impose on animal subjects, with exceptions only for rare situations in which a study promises critical social benefits.

In what follows, I argue against placing a general upper limit on the suffering or harms that researchers may impose on animal subjects for scientific purposes. After examining the moral arguments for an upper limit on harm, I present a counterexample to such a moral restriction. I then explain how the counterexample shows that researchers ethically may impose significant harms on animal subjects provided that they adequately compensate those animals for their suffering. I close by considering and responding to two types of objection to my argument.

1. AN UPPER LIMIT ON HARM IN ANIMAL RESEARCH

David DeGrazia and Tom Beauchamp recently have articulated six necessary conditions for ethical research with sentient, nonhuman animal subjects. One of these conditions, the "Principle of Upper Limits to Harm" (PULH), prohibits research "in which animal subjects are expected to endure severe, long-lasting suffering," such as "suffering that cannot be ameliorated by appropriate anesthesia, analgesia, sedatives, changes in living conditions, or the like and persists for

a significant length of time"(DeGrazia and Beauchamp 2020, 16).[1] This prohibition may be overridden in "rare, extraordinary cases," specifically those in which the research advances "critically important social and scientific purposes" (18). PULH resembles a 2010 European Union directive's prohibition against causing animal subjects to experience "severe pain, suffering or distress that is likely to be long-lasting and cannot be ameliorated," unless "exceptional and scientifically justifiable reasons" support the research (European Union 2010, 42, 50).

DeGrazia and Beauchamp (2020) do not explicitly defend PULH; however, they and others have provided arguments elsewhere that would support such a principle. One argument claims that sentient animals' moral status entails something like PULH: animal subjects matter morally for their own sake, so researchers have moral reasons to promote their well-being by protecting them from harm. Research that causes animal subjects to experience severe, long-lasting suffering requires a strong justification to override researchers' moral reasons to protect animals from harm, namely, the expectation of immediate and substantial benefits for humans (Beauchamp and Morton 2015, 443–45; Olsson et al. 2019). Another argument defends a principle like PULH on grounds of consistency: researchers usually act unethically when they impose severe, long-lasting suffering on human subjects, even if those subjects have given their full and informed consent to participate in the research. This entails that researchers usually act unethically when they impose similar harms on animal subjects, since the badness of suffering does not vary depending on the kind of creature that experiences it (Barnhill, Joffe, and Miller 2016, 23–4; Beauchamp and Morton 2015, 444).

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[1] PULH is somewhat inaptly named, as it places an upper limit on only one type of harm, namely, experiential suffering. It is plausible that there are other ways of setting back an individual's interests that also qualify as harms, such as preventing an individual from receiving a significant benefit. Unless otherwise noted, I use the term "harm" to refer to experiential harm.

If PULH were true and rigorously enforced as policy, it would have a significant impact on current research with animal subjects. Researchers in the United States use tens of thousands of animal subjects annually in "Category E" studies in which animal subjects do not receive treatment for pain for some period of time, and at least some of these animals endure severe, long-lasting suffering (Carbone 2011, 2020).[2] Current U.S. regulations do not place a general upper limit on the amount of suffering which animal subjects may experience in the course of research; however, the regulations do prohibit certain procedures, notably, the use of paralytics on animals undergoing painful procedures without anesthesia. More widespread enforcement of PULH could interfere with infection challenge studies with deadly pathogens such as Ebola virus (Barnhill, Joffe, and Miller 2016), brain injury studies involving blasts or blunt trauma (Pound 2020), and studies of biological mechanisms of cancer-related pain (Pineda-Farias, Saloman, and Scheff 2020), among other types of research. Although researchers sometimes could mitigate animal subjects' suffering in these studies with anesthesia and timely euthanasia, they could not always do so without undermining core scientific objectives of the research.

In the following, I argue that PULH is false and does not justify policies that would place a general upper limit on the harms researchers may impose on animal subjects. Researchers do not necessarily act unethically when they impose severe, long-lasting suffering on animal subjects, even if the research will not provide immediate or substantial benefits for humans. For the sake of argument, I assume the truth of DeGrazia and Beauchamp's (2020) other principles of ethical research with animal subjects. First, the research must meet three requirements of social benefit: the use of animals has no ethically acceptable alternatives, researchers reasonably expect that the

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[2] Neither DeGrazia and Beauchamp (2020) nor the European Union (2010) directive specify what types of harm or suffering would qualify as sufficiently "long-lasting" to justify their prohibition in animal research. For the sake of argument, I assume that PULH concerns severe harms that last longer than mere minutes (i.e., they are "more than . . . momentary"; Carbone 2011, 5).

study will provide a net benefit for humans, and any harms animal subjects suffer are justified by the expected benefits of the knowledge gained (DeGrazia and Beauchamp 2020, 6–11). Second, the research must meet two requirements of animal welfare: researchers impose only scientifically necessary harms on animal subjects and satisfy their basic needs as much as possible, consistent with the scientific goals of the research (11–6).[3] Readers who believe that DeGrazia and Beauchamp's overall ethical framework for animal research is excessively permissive, perhaps because it does not acknowledge animals' moral rights or their claims of distributive justice, likely will be unconvinced by the following argument.

2. A COUNTEREXAMPLE TO THE "PRINCIPLE OF UPPER LIMITS TO HARM"

Consider the following hypothetical case:

Paulo: Paulo is a common marmoset who has lived his entire life in a humane facility where he receives minimally appropriate care. At age seven, researchers enroll Paulo as a subject in a study aimed at developing new scientific knowledge of anatomy and disease pathogenesis. The study is internally and externally valid, and researchers expect the knowledge gained will benefit humans; however, the net benefits may be small and realized only in the distant future. Unfortunately, gaining this knowledge requires subjecting Paulo to slightly painful interventions while under anesthesia over several days, and then painlessly euthanizing him to measure the interventions' effects on his physiology.

The research involving Paulo appears to be ethically permissible, as it satisfies PULH and DeGrazia and Beauchamp's (2020) other requirements of social benefit and animal welfare. The

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[3] The "Principle of Basic Needs" entails PULH if animals have a basic need to avoid severe, long-lasting suffering. However, DeGrazia and Beauchamp reject this interpretation (2020, 16), so I also reject it for the sake of the present discussion.

research satisfies PULH because at no point does Paulo experience severe or long-lasting suffering. The study's design and inclusion of anesthesia mean that the researchers impose only scientifically necessary harms on Paulo. Aside from those harms, Paulo has his basic needs met as part of minimally appropriate animal care. The research requires harming animals in order to obtain knowledge expected to provide a net benefit for humans, and while the expected benefits are modest, they nonetheless seem to justify harming Paulo.

Some readers might not share the intuition that the research involving Paulo is ethically permissible, perhaps because Paulo is a nonhuman primate or because the researchers harm him by painlessly euthanizing him. However, these aspects of the case are inessential to the following argument. Readers might imagine that this case (and the following case) features a rat or a rabbit instead of a nonhuman primate, or that Paulo was genetically engineered to die of natural causes before his eighth birthday, and therefore the researchers complete the experiment without euthanizing him. Further, even if the research involving Paulo were ethically impermissible overall, this clearly would not be due to the fact that the researchers violate PULH, since Paulo never experiences severe or long-lasting suffering.

Compare Paulo's case with the following hypothetical case:

Ana: Ana's situation is exactly the same as Paulo's, except that the research requires subjecting her to long-lasting, severely painful interventions without anesthesia over several days. After completing these interventions, the researchers provide Ana with full treatment and rehabilitation for her study-related injuries. They then send her to a special sanctuary where former animal subjects live in a stimulating, highly naturalistic environment that promotes their well-being far beyond what their wild conspecifics enjoy. For instance, the animals receive diets consisting exclusively of their most favorite foods, ample resources for play and exercise, mood- and experience-enhancing drugs, and enriched social and sexual

interactions with conspecifics, all while being protected from pain, disease, and even most unpleasant experiences. Ana lives an extraordinarily happy, flourishing life at the sanctuary for ten years before dying of natural causes.[4]

If PULH is true, then it seems that the researchers in Ana's case act unethically while the researchers in Paulo's case do not. Unlike in Paulo's case, the researchers in Ana's case violate PULH by imposing severe, long-lasting suffering on an animal subject in order to gain scientific knowledge expected to yield only modest benefits in the distant future. Apart from this violation, the researchers in Ana's case appear to satisfy DeGrazia and Beauchamp's (2020) other requirements of social benefit and animal welfare. Like in Paulo's case, the researchers meet Ana's basic needs, they harm her only to the extent required to achieve the study's scientific objectives, they reasonably expect the study to provide a modest net benefit for humans, and the overall value of the study justifies imposing at least some harm on animal subjects.[5]

The result that the researchers act unethically in Ana's case but not in Paulo's case reveals a problem with PULH. Specifically, PULH counterintuitively entails that considerations of animal welfare weigh more heavily against the research in Ana's case than the research in Paulo's case, even though the researchers make Paulo's life much worse than Ana's in terms of overall lifetime well-being. Ana and Paulo fare equally well for the first seven years of their lives, but Paulo then experiences slight pain over several days before dying painlessly. Ana experiences severe, long-lasting suffering over several days as a research subject, but then recovers from her injuries and experiences another ten years of extraordinarily happy life. If you had to choose to live the life of one of these animal subjects, choosing to live Ana's life would be justified, if not rationally

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[4] Paulo's and Ana's cases are inspired in part by David Wendler (2014).

[5] If DeGrazia and Beauchamp's (2020) "Principle of Sufficient Value to Justify Harm" is a meta-principle for ethical animal research (De Waal 2020, 62), then its satisfaction in Ana's case depends on the truth of PULH. The argument against PULH below supports the view that the research has sufficient value to justify harming Ana.

required. This judgment conflicts with PULH, which ranks the research in Ana's case as ethically inferior to the research in Paulo's case in light of animal welfare considerations.[6]

Ana's case serves as a counterexample to PULH since that principle implausibly entails that the researchers act unethically in virtue of how their actions affect Ana's well-being even though the researchers ensure that she enjoys a much better life than Paulo. In the next section, I explain why PULH leads to this counterintuitive moral judgment.

3. HARM AND COMPENSATION IN ANIMAL RESEARCH

PULH yields a counterintuitive result in Ana's case because it conflates the meaning and moral significance of pro tanto harm and net harm (Feinberg 1986, 146). A *pro tanto harm* makes the sufferer worse off with respect to some aspect of their well-being. If an acquaintance drugs you so that you fall unconscious, lacerates your face in multiple places, and takes thousands of dollars from you, then you suffer pro tanto harm. However, not every pro tanto harm counts as a *net harm*, which makes the sufferer worse off with respect to their overall lifetime well-being. If the acquaintance cuts up your face and takes your money as part of a cosmetic surgery you arranged to promote your acting career, then you certainly suffer pro tanto harm, but not necessarily net harm. The pain and financial loss from the surgery make you worse off in some respects, but they are necessary for changing your appearance in order to flourish as an actor, which may be much better for you in terms of your overall lifetime well-being. As this example shows, imposing a pro tanto

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[6] DeGrazia and Beauchamp (2020) allow for exceptions to PULH in rare cases where imposing severe harms serves "critically important social and scientific purposes" (18), and Barnhill and colleagues (2016) have articulated criteria for when severely harmful research with nonhuman primates would be justified on such grounds (24). However, Ana's case does not appear to satisfy the criteria that would warrant an exception to PULH: the research is expected to impart modest net benefits to humans in the distant future, not significant benefits to humans in the near future. Therefore, if the researchers act permissibly in Ana's case (or at least not less ethically than in Paulo's case), then this is not because PULH allows for exceptions for research with critical importance for human well-being.

harm can be morally permissible when it does not result in net harm, but rather results in a large net benefit.

Consider how the distinction between pro tanto harm and net harm applies to the cases of Paulo and Ana. Both Paulo and Ana suffer pro tanto harms as research subjects, though only Ana experiences the pro tanto harm of severe, long-lasting suffering. The pro tanto harms of mild pain and an early (though painless) death suffered by Paulo likely result in net harm: had the researchers not imposed the study interventions on Paulo, he would have been better off in terms of his overall lifetime well-being.[7] In Ana's case, however, the pro tanto harms she suffers as a research subject do not result in net harm. The researchers provide Ana with such an extraordinarily good life precisely because they previously subjected her to severe, long-lasting suffering in the study. Had Ana not experienced that suffering (say, by being enrolled in Paulo's study instead), the researchers subsequently would not have done as much to promote her well-being. On the plausible assumption that Ana has a very good life overall despite the suffering she experiences as a research subject, the pro tanto harms the researchers impose on her do not count as net harms since Ana's overall lifetime well-being almost certainly would have been lower had the researchers not enrolled her in the study.

PULH morally prohibits the imposition of a certain kind of pro tanto harm on animal subjects in most cases, but this prohibition seems plausible only if one ignores the possibility of *compensation*. In the cosmetic surgery example, you expect that the professional and financial benefits you will receive as a consequence of the procedure will fully compensate you for the pro

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[7] Paulo *likely* suffered net harm because his life might not have gone any better for him had the researchers not enrolled him in the study. Had the researchers not enrolled him in the study, different researchers might have enrolled him in a more harmful study. Alternatively, if the researchers never conducted the study (say, because their institution never received funding to conduct animal research), then they might never have created Paulo for that purpose. In that case, Paulo does not suffer net harm because the researchers do not make him worse off, assuming he would not have been better off never existing at all than existing and being involved in the study.

tanto harms you suffer, thereby preventing you from suffering a net harm. In Ana's case, the ten additional years of extraordinarily good life that the researchers provide to her after her involvement in the study appear to fully compensate her for the severe, long-lasting suffering she experiences as a research subject. By ignoring the possibility that researchers may compensate animal subjects in order to mitigate or even eliminate the net harm they suffer, PULH leads to the counterintuitive conclusion that the researchers act more ethically in Paulo's case than in Ana's case.

How much compensation should researchers provide to animal subjects who suffer severe, long-lasting harms (or even other harms) for the advancement of science? In other words, how much overall well-being must researchers ensure that animal subjects enjoy in order to justify imposing serious pro tanto harms on them? One potentially attractive answer is that animal subjects deserve the maximum overall well-being that is consistent with sound science. While this answer recognizes the moral significance of nonhuman animals' well-being, it does not provide adequate normative guidance for researchers. Sound science requires efficient allocation of limited resources in the pursuit of worthwhile scientific goals, including resources devoted to compensating animal subjects. Therefore, there is no determinate maximum amount of compensation for animal subjects that is consistent with sound science since the available resources determine which scientific goals researchers can pursue.

While I cannot explore fully here the issue of how much overall lifetime well-being researchers must ensure that their animal subjects enjoy, two positions seem promising. One position holds that researchers must ensure that animal subjects have a *worthwhile life*, or a life in which they do not suffer net harm overall.[8] According to this view, adequate compensation would

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[8] David DeGrazia and Jeff Sebo (2015) defend such a "worthwhile-life condition" for morally permissible animal research, which requires that "it cannot be said of the animals that their lives, on the whole, are bad for them" (24–5).

provide sufficient benefits to a severely harmed animal subject to make it the case that the positive

value of the good elements in its life is greater than or equal to the negative value of the bad

elements in its life (McMahan 1981, 105). An alternative position holds that researchers must

ensure that animal subjects enjoy a level of overall lifetime well-being that is equal to or greater

than the average well-being enjoyed by their wild conspecifics. This standard might demand more

compensation for animal subjects than the worthwhile life standard, yet would not lead to excessive

costs that undermine the feasibility of scientific research or its expected long-term benefits for

humans.

That PULH fails to account for compensation's moral significance provides good reason

for rejecting it as a moral requirement and as policy. If enforced as policy, PULH might interfere

with animal research that would provide significant benefits to humans and other nonhuman

animals, such as infection challenge studies (Warfield et al. 2014). Permitting animal subjects to

undergo longer or more intense suffering also could improve the quality and usefulness of certain

kinds of animal research. For example, reducing the amount of anesthesia used on animal subjects

in blast trauma studies could improve the external validity of such research (Pound 2020, 293–94;

Wojnarowicz, Fisher, Minaeva, and Goldstein 2017). Researchers should not forsake these

potential benefits merely to avoid crossing an unjustified upper limit on pro tanto harms imposed

on animal subjects. Institutions should consider allowing research that imposes severe, long-lasting

suffering on animal subjects, provided that researchers adequately compensate their subjects and

minimize their suffering in a manner consistent with core scientific goals.

4. OBJECTIONS FROM IMPLICATIONS FOR HUMAN SUBJECTS RESEARCH

One type of objection to the above argument against PULH claims that it has unacceptable

implications for the ethics of research with human subjects. For instance, one might argue that if

compensation can justify imposing severe, long-lasting suffering on animal subjects without their informed consent, then this entails that compensation can justify imposing severe, long-lasting suffering on human subjects without their informed consent.

This objection equivocates on the significance of harming subjects "without their informed consent." Researchers act unethically when they expose human subjects to serious risks without informed consent because the vast majority of those subjects have either the capacity or the future potential for autonomous functioning, which grounds their right to make free and informed decisions about their own lives (Buchanan and Brock 1989). The vast majority of animal subjects have neither the capacity nor the future potential for autonomous functioning, so their failure to provide informed consent does not give researchers a moral reason to refrain from harming them for scientific purposes. Although this objection fails, it highlights an important limitation of the argument against PULH: nonhuman animals with the capacity for autonomous functioning (or sufficiently similar functioning) should receive similar protections as human subjects, including protections against the imposition of severe, long-lasting suffering.

But why should researchers refrain from imposing severe, long-lasting suffering on human subjects who give their informed consent, provided that the subjects receive enough money (or other non-clinical benefits) to compensate for the harms they suffer? One might object that the argument against PULH entails the permissibility of conducting research in which human subjects are subjected to high risk of very serious harms without any expectation of clinical benefit, even though this violates conventional norms of research ethics.

This objection ignores critical moral concerns about distributive and social justice. Even with the currently stringent limits on risks to human subjects, high levels of compensation for participating in riskier studies might disproportionately attract socially, politically, or economically marginalized volunteers. Well-meaning researchers inadvertently can take unfair advantage of

individual volunteers' vulnerability, which can lead to vulnerable groups bearing disproportionate

burdens of research, among other injustices (Walker, Cottingham, and Fisher 2018). The higher

levels of compensation required to justify imposing severe, long-lasting suffering on human subjects

would exacerbate these concerns. However, the same concerns about distributive and social justice

do not apply to research with animal subjects, otherwise most uses of nonhuman animals in

biomedical research would be morally unjustified. Although serious scholars have defended that

position (Regan 1983), it is clearly inconsistent with Beauchamp and DeGrazia's (2020) overall

ethical framework, so rebutting it is outside the scope of this discussion.

Lastly, one might object that the argument against PULH implausibly entails that

researchers may impose severe, long-lasting suffering on human subjects who lack the capacity or

future potential for autonomous functioning, provided that those subjects receive adequate

compensation for the harms they suffer (Walker 2006). This objection also appeals to concerns

outside the scope of this discussion, but I will offer a partial response. First, enrolling

nonparadigmatic humans in very harmful research risks violating their autonomy rights, given the

substantial uncertainty about their current capacity and developmental potential for autonomous

functioning. Second, even when researchers have greater certainty about some humans' lack of

capacity or potential for autonomous functioning (e.g., humans with severe microcephaly), such

humans' radically different psychology and species-atypical physiology lead to substantial

uncertainty about how different interventions will affect their well-being. Third, even without these

uncertainties, imposing severe harms on cognitively impaired humans in research risks

undermining the psychological well-being of other humans with cognitive impairments, who

justifiably would wonder whether researchers would violate their rights if given the opportunity.

Taken together, these considerations support refraining from imposing severe, long-lasting

suffering on nonparadigmatic humans in research, regardless of the truth or falsity of PULH.

5.   OBJECTIONS FROM THE INABILITY TO COMPENSATE ANIMAL SUBJECTS

Another type of objection claims that the argument against PULH misrepresents researchers' ability to compensate animal subjects for research-related harms. For instance, one might argue that researchers usually cannot adequately compensate animal subjects for severe, long-lasting suffering because such research typically requires euthanizing subjects for scientific or safety reasons. Some scholars even distinguish severe from non-severe suffering in part by the special tendency of severe suffering to cause lasting or even unrecoverable harm to an organism, which suggests that researchers definitionally cannot compensate animal subjects for such harms (Olsson et al. 2019, 407–8).

This objection highlights an important limitation of the argument against PULH: researchers sometimes will not be able to provide adequate compensation for severe, long-lasting harms suffered by animal subjects. For example, imposing extreme physical or psychological harms on very young animal subjects can doom their ability to enjoy a net positive well-being over the course of their life. To ensure that animal subjects receive sufficient benefits to justify the harms they suffer, researchers often will need to compensate those subjects *before* imposing research-related harms. Researchers can identify which animals will undergo severe, long-lasting suffering later in life and provide those animals with additional benefits beyond the requirements for humane treatment, such as extraordinary goods like those Ana receives at the sanctuary.

In what I call *precompensation*, providing sufficient benefits to animal subjects prior to their involvement in research can prevent the pro tanto harms they later suffer from seriously negatively affecting their overall lifetime well-being. Assuming that animal subjects receive care that ensures they have a positive overall well-being on an average day, one way researchers can

precompensate them for later harms is to delay the age at which the animals suffer research-related harms. For example, enrolling a nonhuman primate in an Ebola virus challenge study at age seven rather than age three gives the subject the opportunity to enjoy more good life before it suffers severe pro tanto harms in research, thereby reducing the net harm it suffers.[9]

A second objection maintains that researchers and oversight officials cannot make reliable judgments about how to compensate animal subjects who suffer serious harm (Hare 2020). Animals cannot communicate as most humans can about how much certain experiences harm them and what additional benefits they would need to ensure a positive overall lifetime well-being. Even experts often cannot assess accurately how different conditions will harm or benefit different animals (Gruen, White, and Hare 2020; Mason 2010).[10]

Although researchers and oversight officials often will not know enough about factors that influence animal subjects' well-being to ensure that they receive adequate compensation for severe, long-lasting suffering, this will not be the case always. Like with humans, if an animal lives a long life in which it usually enjoys species-typical goods, then experiencing several hours of intense pain before death would not make the animal's life as a whole not worth living (i.e., it would have a net positive value for the animal). Researchers therefore could be justified in imposing the kinds of harm that would facilitate infection challenge studies or blast trauma research on animals whom they have kept in excellent living conditions for most of their natural lives, provided that the research meets other ethical requirements. Enforcing PULH as policy could prohibit even studies in which researchers and oversight officials confidently judge that animal subjects will not suffer excessive net harm.

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[9] For further discussion of the limits of compensation, see Wendler's (2022) "Suffering in Animal Research: The Possibility of Compensation and the Need for Limits" in this volume.

[10] This objection exemplifies a more general challenge for consequentialist approaches to ethics, namely, the uncertainty involved in making judgments about how different factors affect others' overall well-being. Addressing this more general challenge is beyond the scope of this discussion.

This objection highlights a surprising implication of the argument against PULH. The potential benefits for humans from very harmful animal research weigh in favor of conducting such research. However, it is plausible that such potentially valuable research is morally permissible only if animal subjects receive adequate compensation. Many animal subjects can receive adequate compensation for severe, long-lasting suffering only if researchers improve their scientific understanding of animal well-being. Therefore, the potential benefits for humans from very harmful animal research weigh in favor of advancing the science of animal well-being. In other words, researchers should learn more about animal well-being in part because this will allow them to conduct potentially valuable research that imposes severe, long-lasting suffering on animal subjects.

6. CONCLUSION

I have argued against placing a general upper limit on the harms that researchers may impose on animal subjects because in many cases those subjects can receive adequate compensation even for severe, long-lasting suffering. The moral permissibility of imposing serious pro tanto harms on animal subjects turns on the scientific and social value of the research and on whether the compensation the animals receive sufficiently mitigates the net harm they suffer. Given the important moral differences between the large majority of humans and the large majority of nonhuman animals, this argument does not support imposing severe, long-lasting suffering on human subjects. This argument also does not support severely harming animal subjects without sufficient scientific knowledge of how to compensate them adequately; however, it does provide additional moral reason for researchers to improve their understanding of animal subjects' well-being. Although the argument here has focused on scientific research with animal subjects, it might

have ethical implications for other activities in which nonhuman animals suffer serious harms in order to benefit humans.[11]

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