

Necessary Conditions for Morally Responsible Animal Research

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Abstract: In this paper, we present three necessary conditions for morally responsible animal research that we believe people on both sides of this debate can accept. Specifically, we argue that, even if human beings have higher moral status than nonhuman animals, animal research is morally permissible only if it satisfies (a) an expectation of sufficient net benefit, (b) a worthwhile-life condition, and (c) a no-unnecessary-harm/qualified-basic-needs condition. We then claim that, whether or not these necessary conditions are jointly sufficient conditions of justified animal research, they are relatively demanding with the consequence that many animal experiments may fail to satisfy them.

The purpose of this paper is to propose several necessary conditions for morally responsible—that is, morally justified or permissible—animal research. This paper is addressed to proponents of animal research who are sympathetic to the idea that it raises ethical issues, but who think that animal research is morally justified all things considered—at least in many cases. For this reason, we will assume a conception of moral status that is relatively accommodating of animal research. In particular, we will assume that all sentient animals have moral status,¹ but that persons have a higher moral status than nonpersons.²

What does it mean to say that all sentient animals have moral status? For present purposes, we mean that we have a moral obligation to consider the interests of all sentient animals when deciding what to do. What does it mean to say that persons have a higher moral status than nonpersons? There are two plausible interpretations of this claim. The first is what might be called “Kantianism for persons, consequentialism for nonpersons.”³ On this interpretation, we have a moral obligation to treat persons as ends in themselves, whereas we do not have a moral obligation to treat nonpersons as ends in themselves. Instead, our only moral obligation to nonpersons is to consider their interests when deciding what to do (where this consideration is compatible with our harming them for the greater good). Second, the claim that persons have higher moral status than nonpersons might mean that we should weigh the interests of persons more heavily than the interests of nonpersons when deciding what to do.⁴ On this interpretation, it is a further question how much more heavily we should weigh the interests of persons than the interests of nonpersons, and why. In any case, we will assume for the sake of argument that both of these interpretations are correct: We should treat persons but not nonpersons as ends in themselves, and we should weigh the interests of persons more heavily than the interests of nonpersons when deciding what to do.

Many opponents of animal research will reject this conception of moral status, because they believe that all sentient beings, both human and nonhuman, have equal moral status.⁵ Meanwhile, many proponents of animal research will reject this conception of moral status as well, because they think that all and only persons—or perhaps all and only human beings—have moral status.⁶ Because we intend in this paper to speak to proponents of animal research who are sympathetic with the idea that animal research raises ethical issues, we will engage the middle-ground model of moral status characterized in the previous paragraph. We will present three necessary conditions for morally responsible animal research that are compatible with this model of moral status, and which (we think) reasonable people on both sides of this debate can accept. We will then claim that many animal experiments fail to satisfy one or more of these necessary conditions.

FIRST NECESSARY CONDITION: THE ASSERTION (OR EXPECTATION) OF SUFFICIENT NET BENEFIT

Statement of the Condition

An effort to justify animal research may seek to justify *the institution of animal research*—say, more or less as it is currently practiced—or it may seek to justify *a particular animal experiment*, either prospectively or retrospectively. In between these possibilities are many of intermediate generality that involve *a particular category of animal research* such as compound testing, noninvasive cognitive studies, or the exploration of new surgical techniques. Regardless of the scope of animal research that one has in mind, justification will depend on an analysis of the risks and benefits of the research, where this risk-benefit analysis incorporates an assumption about the moral status of nonhuman animals. Let us develop this idea more precisely.

Any serious attempt to justify animal research will depend on these three claims, which logically unfold in such a way that the second claim incorporates the first and the third claim incorporates the first two:

- (1) Animal research offers *unique benefits* to human beings;
- (2) These unique benefits outweigh the costs and any harms caused to human beings as a consequence of animal research, so that animal research offers a *net benefit* to human beings;

(3) This net benefit to humanity is *sufficiently important* that, when differences in moral status between humans and animals are taken into account, it justifies the harms caused to animal subjects.

Let us call the conjunction of these three claims the *Assertion of Sufficient Net Benefit* (ASNB). Morally serious proponents of animal research believe this assertion to be true.⁷ If ASNB is not true, or not reasonably believed to be true on the basis of evidence, then either a particular study, a particular kind of study, or the entire institution of animal research cannot be morally justified, depending on which is being assessed.⁸

In one respect, ASNB is retrospective. Although it employs the present tense—“Animal research offers ...”—at least most of the evidentiary basis for the assertion (whether systematically investigated, casually observed, or merely assumed) is animal research conducted in the past in view of its costs and benefits; perhaps the evidence also includes information from some current studies. In another respect, ASNB is prospective insofar as it makes a prediction on the basis of available evidence: that animal research will continue to furnish sufficiently important net benefit to human beings. The evidence for the prospective judgment includes not only results from past research and any available data from current studies, but also information about possible future trials that marks them out as especially promising (e.g., anticipated developments in genomics, stem cell science, or brain imaging technology that may intersect importantly with animal research). In view of this prospective standpoint, we may also speak of the *Expectation of Sufficient Net Benefit* (ESNB). ESNB is a necessary condition for morally justified animal research that has yet to be carried out. As with ASNB, a proponent of animal research may assert ESNB in an attempt to justify either a particular study, a particular kind of study, or the entire institution of animal research.

When we distinguish the different levels of generality at which we might assess animal research, an interesting possibility opens up: Someone who largely opposes animal research might judge that a particular experiment meets ESNB—and perhaps other necessary conditions, as discussed later. Thus, an animal protectionist who denies that animals have lower moral status than persons might nevertheless, for example, approve of certain behavioral studies that do not harm animal subjects while affording them a high quality of life, permitting them to live following the experiment, and generating unique, important scientific insights. It is even possible that such an animal protectionist would judge an entire category of animal research, not just particular experiments, to be justified—assuming other necessary conditions are met—if the category is adequately circumscribed (e.g., “noninvasive, nonlethal cognitive studies with appropriate living conditions”). This possibility is important because it shows that participants in the debate over the ethics of animal research need not be as polarized as is sometimes supposed, and that some nontrivial categories of animal research might be acceptable both to animal protectionists and to animal research advocates (see also note 8).

Analysis of the Assertion (or Expectation) of Sufficient Net Benefit

Before we proceed to other necessary conditions, reflections about the three claims that constitute ASNB will be instructive. In summary form, ASNB states that animal research offers (1) *unique* benefits—and (2), overall, *net* benefits—to humanity that (3) are *sufficiently important* to justify harming animal research subjects. Each claim merits closer examination.

In saying in the first claim that animal research provides *unique* benefits to humans, the idea is that the benefits cannot be obtained, ethically, without animal research. The qualification “ethically” is

critical, because it would always be *possible* to skip animal trials and proceed to human trials in pursuit of some benefit. Yet one might reasonably judge, say, that the initial attempt of a new surgical procedure—a procedure that seems both very risky and potentially very beneficial—on a living being should not be performed on a human being (although there may be exceptions in extraordinary circumstances). One who made this judgment would consider the opportunity to learn about the procedure by trying it on animals a unique benefit in the relevant sense.

The second claim is that, once both the unique benefits of animal research for human beings and the associated harms and costs to human beings are accounted for, animal research offers a *net* benefit to humanity. The cost-benefit analysis comes out positively for humanity. Is this true?

There is a large literature on the harms and benefits of animal research that we will not endeavor to summarize or reference extensively here. However, it is worth emphasizing several key points. First, we do not currently have much evidence that animal research offers a *net* benefit to humans.^{9 10 11 12} For the most part, what proponents of animal research who appeal to its benefits present in the way of evidence are anecdotes of successful, important animal trials. Second, a full assessment of this claim of unique net benefits requires more than evidence of *actual* past harms and benefits caused by animal research, for it also requires consideration of *counterfactual* past harms and benefits—that is, what, in view of available evidence, would likely have happened if we had conducted less, or more, animal research. Third, insofar as we have alternatives to animal research that we previously lacked (e.g. computer modeling, stem-cell-based models), evidence of unique past benefits does not necessarily count as evidence of unique future benefits.¹³

A fourth point is critical but often overlooked: Whereas we do not have overwhelming evidence that animal research offers unique benefits to humanity, we have ample evidence that it is very costly to human beings.^{14 15 16} Specifically, the costs of animal research include not only the financial and opportunity costs entailed by conducting animal trials, but also the following: (a) *false toxicity negatives*, in which interventions appear safe for animal test subjects yet prove harmful to humans; (b) *false toxicity positives*, in which interventions appear unsafe for animal test subjects though they would be safe for humans; (c) *false efficacy negatives*, in which interventions that fail to work in animal test subjects would work in humans; and (d) *false efficacy positives*, in which interventions that work in animal test subjects prove useless in humans. Where these costs are known, they are often very high; where they are unknown—as they usually are in (b) and (c)—they invite concerns about possible missed opportunities for medical breakthroughs.

Importantly, it is not only animal protectionists who have challenged the assumptions that animal research provides unique benefits and, ultimately (after costs and harms have been factored in), net benefits to humanity. Leading figures in biomedicine sometimes convey doubts about these assumptions. For example, former NIH Director Elias Zerhouni, in a return visit to NIH, lamented over-reliance on animal data: “The problem is that it hasn’t worked, and it’s time we stopped dancing around the problem.... We need to refocus and adapt new methodologies for use in humans to understand disease biology in humans.”¹⁷ Current NIH Director Francis Collins, in an article discussing the translation of basic biomedical science into safe and effective clinical applications, also expressed significant reservations about animal models. As for safety, “[t]he use of small and large animals to predict safety in humans is a long-standing but not always reliable practice in translational science.”¹⁸ About efficacy, he stated that “[t]he use of animal models for therapeutic development and target validation is time consuming, costly, and may not accurately predict efficacy in humans.”¹⁹ Collins called for the development of “more reliable efficacy models that are based on access to biobanks of human tissues, use of human embryonic stem cell and induced pluripotent stem cell models of disease, and

improved validation of assays,” adding that “[w]ith earlier and more rigorous target validation in human tissues, it may be justifiable to skip the animal model assessment of efficacy altogether.”²⁰ In a recent editorial, *BMJ* Editor-in-Chief Fiona Godlee remarked that a “fundamental problem casts doubt on the validity of clinical research: the poor quality of the animal research on which much of it is based. ... Funds might be better directed towards clinical rather than basic research, where there is a clearer return on investment in terms of effects on patient care.”^{21 22} It is important for proponents of animal research to recognize that major concerns about the costs of, need for, and reliability of animal models are represented by a number of major figures in the biomedical community—and not just on its fringes.

Now consider the third claim: that the net benefit of animal research for humans is sufficiently important that it serves to justify the harms to animal subjects (once differences in moral status between humans and nonhumans are taken into account). The idea behind the parenthetical qualification is that, if—as we are assuming here—humans have higher moral status than nonhumans, we must factor this difference into our assessment of the harms and benefits of animal research. Harms and benefits to humans would count more than harms and any benefits to animals. But how much more should they count—and what is the basis for the answer to this question? Satisfactory answers to these two very difficult questions, which we cannot explore here, would require specification of the way in which, and the degree to which, humans have a higher moral status than nonhuman animals.

SECOND NECESSARY CONDITION: THE WORTHWHILE-LIFE CONDITION

A second necessary condition for morally responsible animal research is that *animal subjects’ lives be worth living*. By this we mean that, once their lives begin, they are expected to be worth continuing for the duration of their lives. Thus, the harms to be imposed on the animals are never so great as to reduce their quality of life to a point at which it would be a kindness to kill them humanely; if it would be a kindness to kill them humanely at any point, that would entail that the lives were at that point not worth continuing. The worthwhile-life condition would surely be met when, say, rodent subjects are afforded comfortable living conditions, adequate food, exercise, and access to conspecifics, and are subjected to harms no greater than the mild pain associated with an occasional needle stick. When this worthwhile-life condition is met, it cannot be said of the animals that their lives, on the whole, are bad for them.

Why accept the worthwhile-life condition? We find several considerations compelling. First, it seems wrong to bring into existence lives—whether human or nonhuman—that are expected to be of such poor quality that they are not worth living. Second, certain *special relationships* seem to entail protective obligations on the part of individuals who occupy the more powerful position in such relationships. For example, human parents owe their children much in the way of protection, nurture, and support; trying to secure for their children lives that are worth living is one (but only one) necessary condition for good parenting. As for pets, their human “caretakers” or “companions” owe them much in the way of protection, nurture, and support as well. By plausible extension, the relationship between investigators and animal subjects also embodies protective obligations on the part of investigators—not only because the investigators are partly responsible for the existence of these animals, but also because the investigators have complete control over animal subjects, who are especially vulnerable and dependent on them.²³ (What we say here about investigators may apply also to other research team members, including veterinarians charged with caring for animal subjects.)

In response to this argument, no doubt some investigators will fully agree that the investigator/animal subject relationship embodies an implicit set of caretaking obligations on the part of the investigator. But some may deny our claim. They might argue that whereas parents and caretakers of pets implicitly embrace a socially recognized commitment to the welfare of their children and pets, respectively, animal researchers do nothing implying such a commitment to protect their subjects. After all, the objection continues, many animal researchers may regard animal subjects as little more than tools for the advancement of biomedicine.

This objection is indefensible. The reasoning in its support fails to acknowledge the source of our obligation to ensure that the individuals we bring into existence or take into our care have lives worth living. We do *not* have this obligation simply because we voluntarily assume it. Consider that, if you bring a child into existence or accept a child into your care, you cannot evade the obligation to ensure that she has a life worth living by insisting that you never voluntarily assumed such a commitment; were you to say this, people could plausibly reply by asserting that you have special obligations to your child, including a special obligation to ensure that she has a life worth living, *not* because you voluntarily assumed such a commitment but rather simply because you *brought her into existence or took her into your care*.

To be sure, one might accept that we have special moral obligations to persons but deny that we have them to nonpersons. Yet such a view is difficult to sustain. Even though we have assumed in this discussion that we should treat persons but not nonpersons as ends in themselves and that we should weigh the interests of persons more heavily than the interests of nonpersons, it does not follow that we owe it only to the persons we bring into existence or take into our care to ensure that they have lives worth living. In order to support this further conclusion, one would need to make further factual and moral assumptions that are likely to be controversial. Moreover, it will be difficult, if not impossible, to make a distinction between companion animals and research animals in this regard. That is, if we have a moral obligation to ensure that companion animals under our care have lives worth living whether or not we voluntarily embrace this commitment—as seems intuitively obvious—then we should presume, in the absence of a compelling argument to the contrary, that we have a moral obligation to ensure that research animals under our care have lives worth living whether or not we voluntarily embrace this commitment.

There is, in addition, a pragmatic reason to accept the worthwhile-life condition. Acceptance of this condition offers an appropriate check on our tendency to ignore, or downplay, the interests of nonhuman animals in the animal research context—a tendency that not only causes significant harm to animal subjects but also, as a result, makes particular studies, particular kinds of studies, and the entire animal research enterprise less likely to pass the sufficient net benefit test. The worthwhile-life condition, then, establishes a baseline for our treatment of animal subjects that ensures that we consider their interests and that our research is more likely to cause greater benefit than harm, overall.

THIRD NECESSARY CONDITION: THE NO-UNNECESSARY-HARM CONDITION

A third necessary condition for morally responsible animal research is that *animal subjects not be subject to unnecessary harms*. What harms count as necessary is determined by the purpose of the research in question. So the no-unnecessary-harm condition states that no harms should be imposed on subjects unless they are strictly required to carry out the study in a scientifically valid way. For example, mice should not be subjected to more blood draws than necessary for the purposes of a study, and the

draws should be performed by a well-trained professional who will not cause more pain than necessary. Meanwhile, handling of the mice should be as gentle as possible.

The no-unnecessary-harm condition may seem obvious to those who take seriously the moral status of animals, but it has striking implications for the ethics of animal research. For instance, if we accept the no-unnecessary-harm condition—and accept the commonsense thesis that the deprivation of basic needs is a type of harm—then it follows not only that we should not cause unnecessary pain and suffering to animal subjects, but also that we should not unnecessarily deprive them of their basic needs.

Imagine, for example, that a genetic study involving rats requires a few blood draws, which are minimized in number and conducted appropriately so that the rats experience very little pain. Imagine further that they are well fed and hydrated, and never incur anything more physically painful than the blood draws. They also have species-appropriate access to conspecifics. But their enclosures are very small and they have virtually no opportunity for exercise and almost nothing to do. It seems that the worthwhile-life condition is met—the quality of life is not so low that it would be a mercy to kill the rats. It also seems that the no-unnecessary-harm condition is met, if we interpret this condition narrowly to include only pain and suffering that results directly from the poking and prodding involved in the experimental procedures. Yet one is struck by how much more could be done to allow these rats to have decent lives that meet their basic needs for exercise and stimulation. Assuming that the reason for the small, boring living quarters has nothing to do with the scientific rationale for the experiment, the neglect seems unjustified and correctable.

At the same time, we can easily imagine cases where certain harms, including the deprivation of basic needs, *is* essential to the scientific rationale for the experiment—and therefore is necessary in the relevant sense. For example, a promising study of the capacity of mammalian bodies to self-heal might inflict a minor injury on animal subjects and withhold veterinary care for a couple of weeks (unless an animal subject's condition worsens greatly) to observe the natural response of subjects' bodies. Such a study would entail a failure to satisfy the subjects' basic needs for freedom from avoidable injury and for veterinary care. But it would not violate the qualified-basic-needs condition because failure to meet these basic needs is necessary for the study and (let us imagine) promises otherwise unattainable insights of sufficient value.

Let us now be more precise about basic needs. By speaking of an individual's basic needs, we mean roughly their essential or most important interests, characterized at a general level. More specifically, a basic need, as we will understand the concept, is *a condition of an individual's life that is crucial for their prospects of having a decent life*. The idea of a decent life moves beyond what is required for a (minimally) worthwhile life in the direction of flourishing, but not so far in that direction as to surpass what can be reasonably expected in ordinary circumstances. Thus the concept of basic needs, as we understand it, is not only descriptive but also normative. Normatively, a basic need is a condition that we may appropriately require individuals in the relevant roles (e.g., human parents or guardians, zoo-keepers, investigators) to meet.

The purposes of this paper call for an approximate, rather than a final, list of animals' basic needs. Further reflection may warrant revision of the list we present here:

- nutritious food, clean water, and safe shelter;
- adequate stimulation, exercise, and opportunities for species-typical functioning (which, for many species, includes opportunities for play);

- competent veterinary care as needed;
- (for at least mammals and birds) access to conspecifics and (for species with strong family bonds) family preservation;
- freedom from conditions that cause significant experiential harm;
- freedom from avoidable disease, injury, and disability;²⁴
- freedom from premature death.²⁵

This robust list of expectations may seem excessive from the standpoint of many in the biomedical research community. But we believe it is sensible. Once we acknowledge that animal subjects are beings with moral status rather than merely our resources, we must treat them in ways that are compatible with this recognition. Moreover, the qualified-basic-needs condition—which follows from the no-unnecessary-harm condition (along with the idea that deprivation of basic needs constitutes harm)—allows for exceptions to meeting basic needs when such exceptions are demanded by the experimental design (and there is sufficient net benefit and a worthwhile life for subjects).

Some circles in the biomedical community already demonstrate a genuine appreciation for animal subjects' basic needs. For example, the Nuffield Council on Bioethics identifies the following rather specific conditions as appropriate for the housing of mice and rats: housing in stable groups; enough space for exercise and normal social behavior; a solid floor with wood shavings; enough vertical space to permit rearing on hind legs; nesting material; material for gnawing; and refuges.²⁶ Despite not addressing all basic needs of rodents, the Council's statement is very much within the spirit of the basic-needs condition that we are discussing.

If investigators sincerely committed themselves to meeting the basic needs of their animal subjects, except where a failure to do so was essential to the scientific rationale for the experiment, much would change in animal research. How much would change would depend on the precise list of basic needs that investigators, supporting funders and institutions, and relevant public policies adopted. Consider what may be the most controversial item on the list: freedom from premature death. Premature death, in the sense we intend, is death—caused by intentional killing or neglect—at a time when continuing to live is still in the animal's interest (assuming the animal is treated properly). If freedom from premature death is accepted as a basic need within the spirit of our proposal, then animals would no longer be routinely killed at the end of experiments; rather, they would have to be cared for or transferred to a responsible facility that could adequately care for them. This would represent a momentous change from current practice. But the basis for counting avoidance of premature death as a basic need is the assumption that premature death constitutes a nontrivial harm to a (sentient) animal. Some will doubt this claim.²⁷ If this item is excluded from the list, then routine sacrifice of animals following experiments could continue. Despite some uncertainty regarding how much would change if this basic-needs requirement were implemented, there can be little doubt that the quality of life of animal subjects would improve considerably due to improvements of their living conditions, opportunities for exercise and species-appropriate social interactions, and the like.

CONCLUSION

We have articulated and defended three necessary conditions for morally responsible animal research:

- 1) THE ASSERTION (OR EXPECTATION) OF SUFFICIENT NET BENEFIT
- 2) THE WORTHWHILE-LIFE CONDITION

3) THE NO-UNNECESSARY-HARM/QUALIFIED-BASIC-NEEDS CONDITION

While primarily addressing proponents of animal research, we have argued that all reasonable participants in the debate over this issue should agree that these conditions are necessary. We leave for another occasion the question of whether these conditions are not only necessary, but also jointly sufficient, for morally responsible animal research.

In either case, these conditions have surprising implications for animal research ethics. In particular, they suggest that many, if not most, of the animal trials that we currently conduct are morally unjustified. For a couple of reasons, investigators who accept these conditions might find these results surprising. First, it is easy to overlook how demanding each condition is. As we have argued, the expectation-of-sufficient-net-benefit condition sets a demanding epistemic standard for morally responsible animal research; the worthwhile-life condition sets a demanding moral baseline; and the no-unnecessary-harm condition places demanding limits on the suffering, confinement, and death that we may impose on research animals. Second, it is tempting, when trying to justify a particular study or kind of study, to focus on just one of these conditions. For example, it is tempting to think that a particular study is permissible because the animals' lives are worth living (neglecting the factor of unnecessary harm), or to think that a particular study is permissible because it imposes no unnecessary harm on the animals (neglecting the issue of worthwhile life). But it is crucial to see that these are all necessary conditions for morally responsible animal research, so that each must be satisfied.

Consider, for example, an experiment that explores the power of cocaine addiction by causing rats to become addicted to cocaine and then frequently testing the strength of their addiction by seeing what intensity of electric shocks they are willing to endure to get the "fix" they now crave. Imagine that the rats in this study transform into miserable beings, driven by irresistible cravings but hurt by powerful shocks and confused by the persisting conflict of desires (to get the drug and not to experience great pain) at the center of their lives. The harms caused by this experiment are necessary given the experimental goal of studying the power of cocaine addiction, but the harms are so great that they apparently flout the worthwhile-life requirement: The rats, presumably, are better off dead than alive under these experimental conditions. We also doubt that this experiment could satisfy the Expectation of Sufficient Net Benefit, but will not press the point.

Throughout this discussion, we have assumed that persons have higher moral status than nonpersons—in particular, that we should treat persons but not nonpersons as ends in themselves, and that we should weigh the interests of persons more heavily than the interests of nonpersons when deciding what to do. If we repealed these assumptions, as many participants in the debate over animal research would, then the implications of our argument would be even more revisionary: Limits to research on animals would in many respects parallel limits to research on human children and adults who, like animals, permanently lack the capacity to provide informed consent. As mentioned at the outset, however, we are interested in exploring animal research ethics from a perspective that people on both sides of the debate can, and do, accept. Accordingly, we have proceeded from the aforementioned assumptions about moral status. We look forward to the thoughtful responses of proponents of animal research who share this middle-ground moral perspective.

Notes

¹ We understand sentience as the capacity to experience (consciously) at least some feelings: sensations, emotional states, or moods. An animal is sentient if he or she can experience *any* feelings at all, even if simply pleasure and pain. We take it as beyond serious dispute that at least mammals and birds—and therefore most animal research subjects—are sentient. For arguments that many animals are sentient, see DeGrazia D. What is suffering and what kinds of being can suffer? In Green R and Palpant N, eds. *Suffering in Bioethics*. New York: Oxford University Press; 2014; 134-153.

² For present purposes, we will understand persons as beings with the capacity for relatively complex forms of consciousness such as those associated with language use, introspective awareness, and planning for the future. Obviously, not all humans are persons in this sense. Thus, the view that persons have higher moral status than sentient nonpersons provokes the problem of nonparadigm humans: the problem of accounting coherently and plausibly for the moral status of those human beings who lack whatever traits are thought to distinguish humans from nonhuman animals for purposes of assigning moral status. This problem, which concerns both infants and certain severely disabled human beings, lies outside the scope of this paper.

³ Cf. Nozick R. *Anarchy, State, and Utopia*. New York: Basic; 1974; 35-42.

⁴ See, e.g., Brody B. Defending animal research: an international perspective. In: Garrett, J, ed. *The Ethics of Animal Research*. Cambridge, MA: MIT Press; 2012; 53-66.

⁵ See, e.g., Regan T. *The Case for Animal Rights*. Berkeley: University of California Press; 1983.

⁶ See, e.g., Carruthers P. *The Animals Issue*. Cambridge: Cambridge University Press; 1992.

⁷ By “proponents of animal research,” we refer to individuals who support a considerable amount of animal research, not individuals who support some, but very little, animal research. By “morally serious,” we mean the disposition to care significantly about what morality demands of us.

⁸ Even if the broader institution is not justified, some types of animal research might be justified. Relatively uncontroversial examples include therapeutic veterinary research, animal research posing no more than minimal risk to subjects, and research involving nonsentient animals. For the most part in the present discussion, we set aside such atypical instances of animal research.

⁹ LaFollette H. Animal experimentation in biomedical research. In: Beauchamp TB and Frey RG, eds. *The Oxford Handbook of Animal Ethics*. New York: Oxford University Press; 2011; 796-825.

¹⁰ Rowan A. Debating the value of animal research. In: Garrett J, ed. *The Ethics of Animal Research*. Cambridge, MA: MIT Press; 2012; 197-214.

¹¹ Bass R. Lives in the balance: Utilitarianism and animal research. In: Garrett J, ed. *The Ethics of Animal Research* Cambridge, MA: MIT Press; 2012; 81-105.

¹² Akhtar A. The flaws and human harms of animal experimentation. *Cambridge Quarterly of Healthcare Ethics* [[current issue]].

¹³ For a helpful discussion of alternatives, see Nuffield Council on Bioethics. *The Ethics of Research Involving Animals*. London: Nuffield Council on Bioethics; 2005; chap. 11.

¹⁴ Greek CR and Greek J. *Sacred Cows and Golden Geese: The Human Cost of Experimenting on Animals*. New York: Continuum; 2000.

¹⁵ Engel M. The commonsense case against animal experimentation. In: Garrett J, ed. *The Ethics of Animal Research*. Cambridge, MA: MIT Press; 2012; 215-36.

¹⁶ Akhtar A. *Animals and Public Health*. New York: Palgrave; 2012; chap. 6.

¹⁷ Quoted in McManus R. Ex-director Zerhouni surveys value of NIH research. *NIH Record* 65 (13); 2013; 1-2, at 2.

¹⁸ Collins F. Reengineering translational science: The time is right. www.ScienceTranslationalMedicine.org 3; 6 July 2011; 1–6, at 3.

¹⁹ See note 19, Collins 2011, at 3.

²⁰ See note 19, Collins 2011, at 3.

²¹ Godlee F. How predictive and productive is animal research? *BMJ* (formerly *British Medical Journal*); 2014; 348; g3719. Godlee's editorial was in response to an article published in the same issue—see note 22, Pound and Bracken 2014.

²² Pound P and Bracken M. Is animal research sufficiently evidence-based to be a cornerstone of biomedical research? *BMJ* (formerly *British Medical Journal*); 2014; 348; g3387.

²³ Cf. Palmer P. *Animal Ethics in Context*. New York: Columbia University Press; 2010.

²⁴ The qualification “avoidable” is meant to characterize diseases, injuries, or disabilities that result from insufficient attention to the animals’ needs as opposed to bad luck.

²⁵ By “premature” here, we have in mind “while it is still in the animal’s interest (assuming she is well-treated) to continue living.”

²⁶ See note 13, Nuffield Council on Bioethics 2005, at 211.

²⁷ If they doubt that animals are harmed by premature death on the grounds they are not persons—roughly, beings with the capacity for relatively complex forms of consciousness—then they should also doubt that human newborns are harmed by premature death. We find it more plausible to judge that human newborns, and other sentient nonpersons (in the above sense of “person”), are harmed by premature death even if persons are harmed to a greater extent by premature death. See DeGrazia D. The harm of death, time-relative interests, and abortion. *Philosophical Forum* 38; 2007; 57-80.