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Experimental Animals

I

In the summer of 1921, two young Canadian researchers, Frederick Banting and Charles Best, made a medical breakthrough by discovering how to treat a fatal disease. For centuries a diagnosis of "juvenile diabetes" (now known as "type one diabetes") had been a death sentence. Fortunate patients in the early twentieth century might survive a year or so after receiving the bad news, but the measures used to control their condition imposed narrow limits on their young lives. Banting and Best isolated a substance, insulin, that enabled a dog whose pancreas had been removed to survive for ten weeks.[1] In the course of their subsequent experiments, another ten dogs (or more) died as a result of the diabetes that had been artificially induced in them. Once the discovery had been confirmed, applications to treat human patients depended on harvesting insulin in large quantities from other domestic animals (initially cattle). By 1923, insulin was available in many countries, and although the early practices of administering it were far from perfect—the insulin was sometimes impure and local doctors were often unable to differentiate insulin shock from an incipient diabetic coma—young diabetics began to have a serious chance of decades of relatively normal life.

My thinking about the topic of this essay was prompted by stimulating discussions with Mark Viney, when we were both Fellows at the Wissenschaftskolleg zu Berlin in 2011–12. I am grateful to Mark for probing comments on an earlier version, to Marty Chalfie for some lively and informative peripatetic conversations, and to Patricia Kitcher for valuable suggestions. Two anonymous referees and the editor offered extremely constructive criticisms of the penultimate draft, and I am much indebted to them.

1. For a lucid and absorbing account of the research that led to this discovery, see Michael Bliss, *The Discovery of Insulin* (Chicago: University of Chicago Press, 1982).

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The example just presented is a very special case. The benefits of the research are impressive (millions saved, not all of them human beings). On the other hand, the costs appear relatively low (a small number of unfortunate animals).[2] Most animal experiments cannot offer so clean a balance sheet. The overwhelming majority do not promise a specific program for tackling a major disease. Often, it would be reasonable to ask just what will be gained from the foreseeable deaths of a very large population of animals. Honest answers would typically have to cite the payoffs that can be expected from a deeper understanding of fundamental aspects of animal metabolism or animal development. "Basic research" can surely be defended on its track record. Yet, since we lack any systematic review of the precise benefits achieved by particular types of experimental investigation, the defenses actually available are, to say the least, impressionistic.[3] Even those who hold it ethically permissible to conduct experiments that have small chances of contributing indirectly to a body of knowledge that will ultimately deliver benefits (for human beings and nonhuman animals) should concede that they are unable to weigh the expected benefits against the suffering of the experimental animals.

How many animals die each year in the world's research laboratories? Estimates are hard to come by, but the grand tally is certainly in the millions. Some sources suggest that more than twenty-five million experimental animals are "sacrificed" in the United States, and another five million meet a similar fate in the United Kingdom. These figures cover *vertebrates*, so that they represent only a (rather small) fragment of the animal kingdom—albeit the group that ought perhaps to be the focus of ethical concerns. Different nations have introduced laws to protect some animals—particularly great apes and some other primates—but the protected class varies from country to country. Equally, there are diverse codes covering just what kinds of procedures are allowed, and

2. It is worth pointing out, however, that the principal animals involved, the dogs, belong to a species with which many human beings have especially close bonds. The cattle, used to harvest the drug, are typically forgotten. Worries about the treatment of the dogs are partly assuaged by well-known photographs of Banting and Best with their dogs, and there is no reason to doubt their genuine attachment to the animals they "sacrificed."

3. I have discussed the need for this type of systematic appraisal a little more extensively in *Science in a Democratic Society* (Amherst, N.Y.: Prometheus, 2011).

how the animals are to be treated before they undergo the interventions prescribed for them.

The legal frameworks erected to guard against wrongful treatment of experimental animals come under fire from two different directions. Some people, including some research scientists, view them as burdensome, as obstacles to biomedical progress (and to scientific knowledge), introduced on the basis of muddled sentimentality. Others hold that the protections do not go far enough, that they fail to take seriously the sufferings of the animals and the complete distortions of their lives. While my initial example (the discovery of insulin) might prompt sympathy for the first line of criticism, it would be easy to adduce examples of gruesome interventions and callous reactions on the part of the experimenters to motivate the second.

My aim in what follows is to clarify the important issues in this debate by adopting a doubly Darwinian perspective.[4] The first Darwinian insight is a central theme of the *Origin*: suffering is not incidental to life but written into the script. Natural selection does not imply that nature is always and everywhere "red in tooth and claw," but a large percentage of competition involves serious truncation of animal life and considerable animal pain. In my diagnosis, much of our thinking about experimental animals is haunted by a pre-Darwinian idea—I will call it "Peaceable Kingdom Thinking"—that contrasts the evils of the lab with a benign "natural" existence. The second Darwinian contribution is the proposal (elaborated in early chapters of *The Descent of Man*) that ethics should itself be understood as a genealogical product, one that might culminate in further "expanding the circle" to extend human sympathies to our nonhuman relatives.[5] I shall start by developing this second

4. A companion essay, "Governing Darwin's World" (to appear in a volume published by Oxford University Press in 2016, edited by Peter Adamson and G. Faye Edwards, discussing perspectives on animals in the history of Western philosophy), traces the approach I pursue here to its sources in Darwin.

5. The idea that the history of ethical life shows expansion of the class of beings deserving ethical consideration is ancient (traceable, perhaps, to the Stoics). Peter Singer uses the metaphor as his title (Singer, *The Expanding Circle*, rev. ed. [Princeton, N. J.: Princeton University Press, 2011]), and in this he follows Darwin. I have attempted to articulate the genealogical perspective on ethics, sketched very briefly in the next section, in *The Ethical Project* (Cambridge, Mass.: Harvard University Press, 2011) and "Evolution and Ethical Life" (to appear in *Biophilosophy*, ed. David Livingstone Smith [Cambridge: Cambridge University Press, 2016]).

theme, and proposing a contractualist[6] approach to our treatment of experimental animals.

II

Contractualism, as I shall understand it, is a thesis about method in ethics. It holds that the best strategy for ethical decision making is to imagine—or, perhaps better, to realize—a conversation in which the participants present and defend their perspectives on the issue at hand. Different versions of contractualism propose rival views about the conditions under which this conversation should take place: they diverge on who should be included in the conversation, on what the participants know, on the methods the discussants should follow in reaching their conclusions, and on the criteria for the eventual outcome.[7] Contractualists also vary in whether they take the method to yield a set of principles that would, in principle, suffice to cover every aspect of ethical life (a complete ethical system), or whether they view it as valuable in making piecemeal progress with respect to an evolving—and always unfinished—project. Some contractualists take the correct application of the method to be constitutive of ethical truth; others contend that there is an independent source of ethical truth, and that their preferred method is the best available means of discovering it.

My version of contractualism follows Darwin and Dewey in thinking of ethics as a historically evolving project. At different historical stages, ethical life has been worked out in groups of different size, probably beginning among small bands of our ancestors more than fifty thousand years ago. Today, the circle has expanded to include all members of our species, including those who are not yet born, and representatives of all human perspectives should be included in an ideal conversation. The participants are envisaged as being aware of all available findings of

6. "Contractualism" is sometimes taken as the name of the position defended in T. M. Scanlon's influential *What We Owe to Each Other* (Cambridge, Mass.: Harvard University Press, 1998). I will use the label to cover the views of other thinkers as well, including John Rawls, Jürgen Habermas, and David Gauthier. Historical precedents for contractualism occur in Hobbes, in Adam Smith, and (perhaps) in Kant's third formulation of the categorical imperative.

7. For John Rawls and David Gauthier, for example, the discussion should conclude with judgments to which all parties agree. For T. M. Scanlon, by contrast, the judgments should be those that none of the parties could reasonably reject.

rigorous inquiry, insofar as they bear on the issue that confronts them. They are also *mutually engaged*. They aim for a final judgment with which all of them can live. So there are three important conditions: inclusiveness with respect to discussants, best available information, and mutual engagement.[8]

Ideal conversation is not expected to yield some system of general principles to cover all possible cases. Because ethics is conceived as an unfinished project, it is to be expected that negotiations will be required many times at different historical stages. As new issues arise, it will be necessary to resume negotiations under as close an approximation to the ideal conditions as we can contrive (or perhaps to think through how some imagined ideal conversation might go). In considering experiments on animals, we should ask whether and how the contractualist method can be applied to the issue, and what conclusions it might deliver.[9]

The discussions of the next sections will be guided by the basic contractualist assumption: some form of conversation is the optimal means of making ethical decisions. I have offered a blunt account of my preferred approach in hopes of remedying some of the vagueness in talking of "ideal circumstances of discussion." While my reflections on

8. This paragraph summarizes a position I have elaborated at some length in *The Ethical Project*. See, in particular, chapter 9.

9. One further point deserves clarification. I do not suppose that the cultural evolution of ethical codes makes progress through tending toward some independently grounded Ethical Truth, nor do I see the history of ethical life as thoroughly haphazard, just "one damn thing after another." There can be progress in ethics, and that progress consists in overcoming the problems experienced in living together. Most fundamentally, our social lives are handicapped by our incomplete capacities for responding to the wants and needs of our fellows. Ethical progress is not teleological, aimed at describing some special aspect of reality. Like many other domains—technology, medicine, for example—ethics makes progress through partially overcoming difficulties we experience. Borrowing a useful idea from classical pragmatism, we can take the ethical truths to be those principles that emerge in progressive shifts in ethical practice, and remain stable thereafter so long as the community in question continues to make progress.

Among the ethical codes of the contemporary world, some shared truths can be identified, principles enjoining honesty, restraint from violence, mutual aid, and so forth, typically expressed as rough generalizations whose exceptions are difficult to specify. Given my approach to ethical objectivity, it follows that the recommended method for ethical decision is not guaranteed to deliver ethical truth, although it can be defended as the most reliable strategy for making ethical progress that we can identify. For much more on the issues of this note, see *The Ethical Project*.

the treatment of experimental animals will be more concrete through formulating them in my (possibly idiosyncratic) terms, it should be easy to understand how different contractualists might reach similar conclusions.[10]

III

On a genealogical version of contractualism, the history of ethical life should include an ever wider population of human beings in an ideal conversation. Yet Darwin's envisaged last step, the inclusion of the nonhuman animals, introduces an apparently insuperable difficulty. For the animals cannot talk (at least not about the complex questions we hope to resolve).

We have met versions of the same problem before, and have learned how to overcome them. Many human beings are unable to participate in conversations about issues whose resolution would have great impact on their lives. The very young, the severely developmentally disrupted, many of the old, and all the members of future generations cannot present their points of view on matters that affect them. With respect to such issues, contractualism—when it is practiced—must include representatives of their perspectives. The same can be done for nonhuman animals.

Indeed, it is being done. We have already taken steps to expand the moral community through including nonhuman animals, and already begun the approach to governance just envisaged. With respect to the use of animals in experiments, oversight committees have been established, and some of their findings are already incorporated into codes of proper behavior. These developments are positive steps. I suggest, however, two main lines of modification.

Contractualism resists a certain idea about ethical expertise. It denies that there are ethical experts with the authority to pronounce a definitive verdict on the case at hand. For contractualists, authority does not lie in the individual but in the group, to the extent that it includes the perspectives of all affected parties, expunges factual error, and seeks a solution

10. In particular, I would expect contractualists to agree on the three conditions on ethical negotiation (inclusiveness, best information, and mutual engagement). I believe that my preferred version presents these conditions in a particularly direct way.

that all can accept. There are no privileged people with special access to a prior moral order who can enlighten others about its character—there is only a particular form of conversation.

To suppose that no single person has the last word is not to deny a different form of expertise. Particular individuals, those who have read widely or reflected deeply, may be particularly talented at facilitating discussion, framing questions, introducing proposed answers, and promoting mutual engagement. Certain kinds of philosophers, or some religious teachers, may take on this role, serving as useful heirs of Socrates. On the other hand, conversation will go awry if some participants insist on the authority of books essentially dependent on factual mistakes, if, for example, Genesis is claimed as factual truth and used as a basis for alleged human rights to use the "lower animals" as anybody pleases. Or they may be distorted in a more subtle way, if the philosopher's pronouncements about ethical principles are seen as having the same status as the geneticist's disclosures concerning the basis of a hereditary disease. These observations have implications for how the members of oversight committees might be chosen.

My second envisaged refinement takes up the complaint, frequently made by animal sympathizers, that their voices are underrepresented (even unrepresented) in discussions of experiments on animals. Research groups and hospitals typically staff oversight committees with medical professionals, leaving only a small number of places for others. Yet we should think carefully about just which people should stand for the animals. Many animal rights activists seem no more committed to mutual engagement than the imagined scriptural fundamentalists of the previous paragraph. Just as we represent infants by people who know a lot about the early stages of life, and represent Alzheimer's patients by people with intimate knowledge of their individual lives and values, so too the advocate for the potential experimental animal should be someone with deep understanding of the sensitivities and the normal course of life of the species in question. Moreover, the medical researchers who propose to conduct the experiment will typically not be those to whom its outcome is most relevant. Especially when the proposed experiment is directed toward a specific disease, the principal affected parties are the animals who may suffer from the experimental treatment and the animals (often but not always human) who need relief from the disease. Arguably both of these parties should be well represented

in the discussion, by people who know and can make vivid both the consequences for the experimental animals and the consequences for those afflicted with the disease. Doctors who might carry out the procedures have an important role to play in explaining what would be done, and a secondary interest that arises from their pursuit of a line of research. The issue of how to strike a good conversational balance is probably one to be settled through empirical trials. I am inclined to start by proposing significant representation both for disease sufferers and for the animals (with experts on their physiology and life cycles, as well as experts on pain), together with a smaller number of medical researchers (both those interested in the line of experimentation under consideration, and those able to make a detached appraisal of its promise), complemented by a large cluster of open-minded outsiders willing to immerse themselves in the scientific details and ready to sympathize with all the parties affected.[11]

IV

Concerns about human treatment of nonhuman animals are typically grounded in two distinct observations. The more obvious of these focuses on the pain experienced by the animals. Some writers, however, would place greater emphasis on the distortion of animal lives. It is not simply that the animals suffer, but that they are placed in conditions entirely at odds with the species-typical "point of view."[12] Both complaints deserve to be taken seriously, but both need to be disentangled from the Peaceable Kingdom Thinking that often encumbers them.

The simplest elaboration of the first worry would be to propose that pain is always and everywhere bad, and that there is consequently a human duty to eliminate it. Simplicity comes at the price of oversimplification. Some pain is willingly undertaken by people who wish to

11. This general proposal adapts the approach to well-ordered science I have advocated in *Science, Truth, and Democracy* (New York: Oxford University Press, 2001) and in *Science in a Democratic Society*. The idea of selecting discussants with particular qualities of intellect and character is indebted to the important work of James Fishkin on citizen juries; see Fishkin, *When the People Speak* (New York: Oxford University Press, 2009).

12. See, for a classic discussion, Tom Regan, *The Case for Animal Rights*, rev. ed. (Berkeley: University of California Press, 2004).

maintain the ability to reach goals they take to be important: Freud's decision not to take the narcotics that would have palliated his terminal cancer, so that he could continue to think and write, is one celebrated example of a common phenomenon. Arguably, if human beings wished to minimize human pain, we should gently euthanize every baby at birth. Moreover, a central consequence of Darwin's *Origin* is that animal suffering is typically unavoidable. It would be absurd to undertake the project of eliminating pain from the animal kingdom, or even to think that we can do much to reduce its frequency. Human beings can *modify* the selection pressures on diverse groups of animals, but only a planetary catastrophe that extinguished sentient life would eliminate the pain that natural selection brings.

A more cautious version of the concern about animal pain would concentrate on the suffering people inflict (not only in the research laboratory but in our agricultural practices as well). Scientists knowingly and deliberately induce diseases in sentient animals. Even if it is impossible to govern Darwin's world after a fashion that will eradicate all pain, humane beings should surely refrain from procedures that directly cause animal suffering. Even here, however, matters are more complex. As researchers will hasten to point out, at least some experimentation on animals aims to reduce the incidence of future suffering, usually for human beings but sometimes also for the species that serves as the experimental subject. Advocates for the animals reply, of course, that, even if the balance of suffering comes out as the investigators claim, the defense is flawed by the repugnant aggregation typical of utilitarianism: the individual animal "sacrificed" in the experiment counts.

After Darwin, we should know that innocence is a myth. To intervene in the natural world is to modify the operation of natural selection. Consequently, some sentient animals will suffer pain they would otherwise have avoided, and others will fare better because of our actions. That would remain true if human beings scrupulously restricted themselves to a plant-based diet—growing the crops to sustain our population entails ecological changes that alter the patterns of animal suffering. Nor can we take refuge in a pious renunciation of intervention. Abstinence is itself a choice. Once we recognize that natural selection will inevitably bring suffering to sentient animals, we have no option but to pick the winners and losers—even if we decide to endorse the

distribution that would obtain in the absence of intervention.[13] There is no Peaceable Kingdom.

Many people who are troubled by animal experimentation would surely be unsatisfied by the discussion so far. They would emphasize the extreme pain, akin to torture, sometimes inflicted upon the animals. They would—reasonably—demand that extreme pain be avoided. In fact, responsible experimenters already use analgesics to lessen animal suffering. Fostering practices of pain reduction and pain management is one goal of the oversight committees briefly examined in the previous section. The contractualist refinements I envisaged attempt to preserve the foreseen medical benefits, while decreasing the pains felt by the experimental animals.

My recommendations are aligned with the "Three-Rs" framework, which attempts to address concerns about the experimental use of animals by advocating *Replacement*, *Reduction*, and *Refinement*. Replacement consists in using dead animals, or animals without highly developed nervous systems, when that is possible; reduction attempts to minimize the number of animals on which experimental procedures are performed; and refinement introduces methods (like administering analgesics) for diminishing suffering. Although few people would deny that this framework is an improvement on the unrestricted use of laboratory animals, most animal sympathizers believe that it fails to go far enough.[14] Indeed, the framework itself needs refinement, but the refinement should be guided by a Darwinian perspective. From that perspective, piecemeal improvements should be valued. They are not minor first steps in some utopian project of eliminating animal pain.

The deeper challenge, however, begins from the thought that some animals have a "point of view," that they are "subjects of a life." The next section responds to this concern.

13. The argument here is parallel to one that occurs with respect to eugenics. Once we understand how to administer genetic tests, we have no choice but to practice eugenics in some form or other. See chapter 8 of Philip Kitcher, *The Lives to Come: The Genetic Revolution and Human Possibilities* (New York: Simon & Schuster, 1996).

14. They are also legitimately concerned that the framework is inadequately applied in individual cases, because of the biased composition of oversight committees. The suggestions of the previous section attempt to address this complaint.

V

Neither the "Three-Rs" framework nor the modifications I have suggested address the charge that the life patterns of experimental animals are distorted. Even if the usual kinds of experiments were performed with perfect elimination of pain, researchers would still be in the business of producing modifications of animal physiology (often severe), containing the animals in highly artificial environments, and subjecting them to premature death. It is easy to view this as depriving the animals of the kinds of lives they typically enjoy.

To fix ideas, it will help to focus on a large class of experiments that usually do not spark protests about the use of animals in the lab. Most of the important contributions to basic biological knowledge obtained during the past few decades have emerged from studying organisms of five kinds: the bacterium *E. coli*, the sea slug *Aplysia*, the nematode worm *C. elegans*, and the fruit fly *Drosophila melanogaster* (the fifth will make its entrance later). Indeed, medical practice has been liberated from harvesting insulin from cows and pigs—as Banting, Best, and their successors used to do—precisely because recombinant DNA techniques now enable the production of human insulin by turning microorganisms into factories that will churn it out to order. Not only has *E. coli* played a major part in the development of those techniques, but it is frequently used as the vehicle for the insertion and activation of the pertinent fragments of DNA.

All five major "model organisms" have been invasively reconstructed in extraordinary ways. To carry out their scientific and medical projects, investigators have to devise a specific type of mutant strain of the original organism.[15] This highly creative work often takes a year or two, involving large numbers of unsatisfactory mutants that are constructed and discarded along the way. Once an adequate model has been found, and generated in sufficient quantities, the main work can begin. Perhaps the organism has been subjected to an analogue of some human disease, which will then be assailed with various potential treatments. Or perhaps the goal will be to halt the life cycle at some particular stage, so as to

15. As the practice develops, "original" comes to refer to a previous artificial strain, developed by someone else, often with several generations of modification behind it, tracing back to a distant ancestor that once lived outside the laboratory.

illuminate patterns of early development. So the organism may be subjected to further genetic manipulation, often severely disrupting its development, or it may be injected with fluorescent proteins enabling cellular processes to be tracked. The researcher is thoroughly in control, deciding what crippling characteristics are to be exhibited, and when exactly this artificial life is to be terminated.

Consider one major accomplishment, sufficient to earn a Nobel Prize, achieved by this style of research. From the late 1970s on, Christiane Nüsslein-Volhard and Eric Wieschaus bred mutant fruit flies whose development was halted at successive early stages. Analyses of tens of thousands of flies with monstrously distorted development enabled Nüsslein-Volhard and Wieschaus to trace the molecular interactions that generate the head-tail axis of the larval fly and that fix its normal segmentation pattern. If, a century from now, developmental biology facilitates programs of treatment for major developmental disorders, in humans and in other sentient animals, Nüsslein-Volhard and Wieschaus will surely be hailed as the pioneers who made these achievements possible.

Yet what they did was profoundly invasive. They deliberately created grotesquely deformed flies, halting their lives at very early stages. On any reasonable understanding of species-standard life patterns, the lives of a very large number of organisms were massively distorted. But this example has not (to my knowledge) aroused major protests. Even those who worry about the treatment of experimental animals do not view the flies as being wronged. If the question even arises, it is easy to console oneself with the thought that a fly's life does not amount to a lot, even at the best of times. Maybe there will be the chance to fly around in the wild and copulate a bit—but it is hard to think that these activities matter much to those who engage in them. Few people attribute to the fruit fly a "point of view."[16]

16. Some Eastern thinkers do ascribe a "point of view" to flies and, on this basis, oppose injuring them. That attitude is occasionally mirrored in Western literature: Tristram Shandy's Uncle Toby releases a fly trapped behind a window, exclaiming, "go poor devil, get thee gone, why should I hurt thee?—This world surely is wide enough to hold both thee and me." But there has been no expressed concern about the names given to some of the *Drosophila* mutants—*Krüppel* (cripple), *hunchback*, *Oskar* (after the central figure of *The Tin Drum*)—even though these naming practices suggest the callous, even sadistic, attitudes occasionally manifested by animal experimenters (for example, the derisory laughter directed at animals after genetic manipulation has rendered them incapable of carrying out their normal movements).

Indignation does arise when similar manipulations (perhaps not as extreme as those in which Nüsslein-Volhard and Wieschaus engaged, but clearly of the same general kind) are carried out on birds and mammals. I shall focus on an example in which laboratory practice is plainly invasive, and in which there are no serious doubts about whether the species from which innumerable variant strains are derived can suffer. My fifth species is the laboratory mouse.

Given what is known about mammalian physiology and neurology, it would be hard to deny that mice can feel pain. How much they suffer varies greatly from experiment to experiment. Yet, even if the animals were given analgesics that completely prevented pain—sometimes impossible, given the experimental goals—the modifications to which they are subjected are often grotesque. They are saddled with diseases deliberately intended to mimic those that afflict human beings; genetic changes or neural surgeries disrupt their development and behavior. Behind these specific interventions stands a long practice of artificial breeding. Many of them come from the Jackson Laboratory (or "Jax lab," a nonprofit organization in Maine) before they are distributed to the world's research laboratories, there to be further manipulated as the investigator sees fit. Laboratory mice are genetically distant from their wild ancestors, and sometimes regarded as a separate subspecies (*Mus musculus laboratorius*).[17] To ensure genetic stability, strains are usually derived from at least twenty brother-sister matings. Many strains show chromosomal aberrations and distortions of normal development.

Yet it is not merely that the Jackson Laboratory, like the investigators who cleverly tinker with its basic strains, seems to construct animals designed to suffer. Imagine an oversight committee, charged with assessing a proposed experiment on laboratory mice, *and assured that pain will be so well managed that the animals will suffer no more than any typical wild mouse in a standard environment—or even that they will suffer less*. The committee must still address the second challenge: have the life patterns been so distorted that the animals have been wronged?

As I have conceded, mice, like other mammals, can be seen as "subjects-of-a-life." The concession appears to entail a consequence:

17. See, for example, Hans Hedrich, ed., *The Laboratory Mouse* (London: Elsevier, 2004), p. 10. This book is by no means the only place in which the subspecies receives this (jocular?) name.

mice are victims of harm and deprivation when their normal life cycles are distorted.[18] Yet caution is needed in taking this step. We might think that the lab mouse does not have much of a life—and, moved by Peaceable Kingdom Thinking, compare its plight with the lives of its free-living cousins. Recall, however, that the laboratory mouse is genetically distant from its wild forebears, perhaps even a distinct subspecies. To place it in the environment of its wild-type ancestors would be an act of gratuitous cruelty. Lamenting its inability to frolic in nature is misguided: we should have no regrets stemming from the fact that contemporary wild horses cannot run in the environment of *Eohippus*, or that sparrows cannot fly around with *Archeopteryx*. The oversight committee should pose a different question: Can the scientists who constructed these special-purpose animals provide them with an environment in which their drives, including those they continue to share with their ancestors, can be satisfied?

There are professional codes for treating laboratory animals, and these sometimes take up the critical issues. They stipulate minimal cage sizes and require that social needs of social animals (like mice) be met and that animals be isolated only for welfare, for veterinary reasons, or for the purposes of the experiment. Conscientious investigators sometimes debate the issue of whether enhancements of the standard environment are warranted. They struggle to assess the animals' welfare when richer options are offered to them. When mice live in cages equipped with devices for play and exploration, they sometimes show higher levels of stress hormones, prompting reflection on whether this is welcome stimulation or a cause of anxiety.[19]

Is there an inevitable loss when animals are given an environment different from that of their wild ancestors, or when they are modified so that living in that environment would be dangerous, even impossible, for them? Peaceable Kingdom Thinkers might note that the lab mouse loses not only the joys of scampering through the pristine woodland but also the thrills of evading the hungry owl. Estimates of mortality for wild mouse populations suggest that 45 percent of these animals die each

18. See Regan, *The Case for Animal Rights*, pp. 363ff. Lori Gruen conceives animal well-being in different terms, but with similar emphasis on the normal life cycle; see Gruen, *Ethics and Animals* (Cambridge: Cambridge University Press, 2011), chap. 4.

19. See Hedrich, *The Laboratory Mouse*, p. 403.

month. Thus, the probability that a wild mouse will live as long as a lab mouse potentially can (one year is a conservative figure) is $(0.55)^{12}$, or a bit less than eight in ten thousand.[20] The oversight committee might ponder whether a laboratory life of a year or more, in an environment that provides regular food and opportunities for social interaction, followed by an intervention in which pain is minimal and a subsequent managed death, is necessarily inferior to one in which monthly mortality is high and the end may be preceded by considerable pain.

In reflecting on that question, it is important to take the Darwinian perspective, appreciating both the pressures of natural selection in the wild and the differences between the artificially constructed laboratory animals and their wild relatives. Our ten-thousand-year-old practice of animal domestication provides a background for considering the permissibility of specific experimental proposals. Most of the animals with which human beings interact most frequently and most intensely have lost capacities possessed by their feral ancestors. Dedicated pet owners work hard to provide environments in which the impulses they recognize in their pets, including those the animals share with their wild relatives, can be safely satisfied. Existing manuals for the management of laboratory animals often reveal a dominant concern for the health and safety of the personnel who will interact with them—with details on how to handle the animals so as to avoid being bitten, for example.[21] But that is an accidental feature that might be transcended in a more sensitive laboratory practice. Current deliberations about space, social interaction, and the potential benefits of an enriched environment already indicate a nascent sympathy to the animals' needs. Future experimentation could go further, emulating the attitude of the responsible pet owner.[22]

20. The estimate of monthly mortality comes from Christopher Collins and Roland Kays, "Patterns of Mortality in a Wild Population of White-footed Mice" (2014), www.researchgate.net/publication/264121847_Patterns_of_Mortality_in_a_Wild_Population_of_White-footed_Mice.

21. Many protections for lab technicians are already built into the breeding of the mouse strains. The Jax Lab carefully monitors the mice to ensure that they are free from diseases that affect human beings.

22. Some advocates for animals would deny that *any* environment can replace life in the wild. A consequence of this position is that the ten-thousand-plus-year history of animal domestication was a moral blunder, requiring us to undo it as speedily and humanely as possible. This view is perhaps the ultimate in Peaceable Kingdom Thinking. It fails to appreciate the Darwinian insight that the work of breeders is akin to the selective

In accordance with the contractualism I have advocated, I introduce a proposal for oversight committees. For each experiment, consider the possibility of preceding the planned interventions by a year of "lab-normal" life, in which the mice enjoy a controlled environment in which they can satisfy all the drives recognized by experts on their physiology and behavior. If that becomes a condition of the proposed experiment, it may suffice to turn back the challenge of distortion of the animals' lives.

Plainly, if a significant span of lab-normal life were always required, that would impose extra burdens on researchers, and a conscientious and representative oversight committee might decide that, in some instances, those burdens were unjustified. There are two obvious general objections to the requirement that deserve a brief discussion. First, some investigations focus on traits that are only present early in life (recall the embryological studies of Nüsslein-Volhard and Wieschaus). Second, even though "a mammal is a mammal is a mammal" (as Gertrude Stein unfortunately did not say), some lines of research probe characteristics manifested in more behaviorally complex animals (think of neurological experiments on monkeys).

One potential means of responding to the first limitation would be to seek genetic manipulations that can enable a mature animal to manifest the juvenile characteristics. Understanding the genetic bases of phenotypic plasticity (and its loss) can enable interventions in which traits are retained into maturity or even old age. Of course, if the experiments needed to probe the genetic bases would have to use very young animals, the requirement of a substantial period of lab-normal life will generate an analogue of Catch-22: you can avoid breaching the requirement if you gain the genetic knowledge, but you cannot gain the knowledge without breaching the requirement. The hope, of course, is to find ways of bootstrapping from ethically permissible experiments that will successively expand the realm of what is properly allowed.

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processes that pervade the living world. There is no more reason to take as privileged the species that were the immediate feral ancestors of our domestic strains, or to suppose that their environments are the only ones in which animal welfare can be realized. Any dog owner who lives in proximity to half-starved coyotes should appreciate the point.

I should add, however, that many writers who campaign for strong reforms of our practices of dealing with animals do not make the mistake just diagnosed. They often write eloquently about their own interactions with domesticated animals (particularly with pets). Lori Gruen's *Ethics and Animals* is an outstanding example.

Experimentation on monkeys would only satisfy the requirement of a lifespan-equivalent period of lab-normal life under two conditions. The monkeys would have to be sustained in a controlled but satisfying environment, and the period of captivity would have to be extremely long: in the wild, capuchin monkeys live for around twenty-five years. In principle, it would be possible to combine the kinds of observational facilities used to study primate behavior—the Arnhem chimpanzee colony and the Yerkes primate center, for example—with a carefully planned program of using terminally sick animals in interventional experiments. Assuming that these environments can be defended against the charge of distorting the lives of the animals (another issue for the oversight committee), there would seem to be little problem with some procedures that introduce only mild changes into daily behavior—testing the reactions of capuchin monkeys when they and their neighbors are given different types of food (for example).[23] Such experiments can be integrated into the everyday lives of the capuchins. More troublesome issues arise with respect to neurological explorations, and the challenge of life distortion would not be met unless the animal subjects were very old or terminally ill.

The line of thought of this section can be motivated by returning to the example with which this article began. Banting and Best did not operate on animals carefully manufactured to meet their specifications. The dogs were descendants of wild canids, belonging to varieties selected by generations of breeding. If they were harmed by the experiments, that harm consisted in depriving them of the kind of environment a considerate owner might have provided for them, and in subjecting them to procedures that shortened their lives. In effect, I am suggesting that the challenge of distorted lives might be turned back if interventions on experimental animals were preceded by a lifetime's worth of experiencing that type of environment.

VI

In line with the contractualism espoused in Section 2, I have made no attempt to preempt (or even predict) the outcome of discussions aimed

23. These celebrated experiments, controversial chiefly because of the claims originally made on their basis, were carried out at the Yerkes center. See Sarah Brosnan and Frans de Waal, "Monkeys Reject Unequal Pay," *Nature* 425 (2003): 297–99.

at regulating the behavior of an enlarged moral community. To repeat, the philosopher serves as midwife for discussions in an enlarged ethical community, indicating potential ways in which progressive transformations of the ethical code may result from expanding the conversation. My extensions and revisions of the "Three-Rs" framework attempt to turn back general ways of debarring all uses of experimental animals, one based on the pain those animals would experience, the other (to my mind, the more significant) grounded in viewing laboratory life as an inevitable distortion. Hence, I have aimed to open the way for oversight committees to deliberate seriously about the propriety of particular proposed experiments. For these questions, the details always matter.

Yet it is high time to face up to the deepest challenge to using experimental animals, a challenge signaled by the verb—"use"—I have so casually employed. The signal only makes explicit an attitude that has permeated the discussion. Many of the practices surveyed in previous sections envisage animals as *resources*. They are tools to be used in tackling specific questions, much like the centrifuge or the automated sequencer. Service industries provide the equipment, often to the specification of a scientific subcommunity. Nüsslein-Volhard and Wieschaus manufactured their own fly mutants—and the Jax Lab furnishes mice to order. Can either the cottage industries of the individual laboratories or the mass production of mice be reconciled with the solidarity that should bind the members of a genuine moral community?

Critics might reasonably challenge my discussions on the ground that the confrontation with the linguistic incapacities of experimental animals has been superficial. To be sure, the nonverbal members of the human community can be represented by proxies, guardians of their interests. But their inclusion in the conversation depends on our ability to project consent from the many human beings who can declare their explicit agreement to those—the infants, the developmentally disrupted, the demented, future people—who cannot. For experimental animals we have no basis for supposing that they would consent, if only they could talk to us. And without their consent, we can only impose our own plans on them. Consequently, the attempt to broaden the ethical community to include them must fail.

My Darwinian approach to morality conceives successively broader groups as integrating individuals who used to act independently, often even in aggressive competition. Those individuals become responsive to

one another, recognizing and trying to promote one another's well-being, and participating in joint projects. Human beings can conceive of and implement projects in which sacrifices are made for mutual benefit. They can indicate their willingness to give up their own lives, or to suffer severe distortions of their lives, so that the lives of others may be enhanced. But any similar attitude lies beyond the conceptual reach of an experimental animal. Even in the cases that offer the most remarkable benefits, we cannot explain to the mouse or the dog that the operation we plan will enable millions of other animals to thrive.

The critique can go further. It is bad enough that nonhuman animals are recruited to participate in an allegedly cooperative project without their consent, but the hollowness of the supposed "cooperation" is revealed by the fact that *they* make the sacrifices and *we* reap the benefits. That version of the rejoinder overstates. The use of animals in experiments has enriched veterinary medicine, as well as its human counterpart. Nevertheless, the benefits are primarily enjoyed by human beings and the sacrifices are (with a tiny number of exceptions) all on the nonhuman side. Genuine solidarity requires a different balance. Moreover, the exceptions themselves are profoundly disturbing. The examples constitute a class of historical breaches within the human moral community: the Tuskegee experiment, the explorations of the Nazi doctors, and the like. Those investigations have provoked medical ethicists to emphasize the crucial importance of consent. Hence, after all the Band-Aids of earlier sections, we recognize that the wound remains unhealed: so long as animal experimentation is continued, the expanded moral community cannot be realized.

Opponents of invasive experiments on animals, especially those modifying the brains of monkeys and apes, often ask, rhetorically, whether researchers would be prepared to operate in similar ways on children with severe neurodevelopmental abnormalities (children whose psychological functioning is taken to be less developed than that of the primates targeted for the interventions). The question stops the conversation because it is assumed that *nobody* would be prepared to tolerate neuroscientific experiments on the brains of living human beings. Once that assumption is made, the possibility of genuinely balanced human and nonhuman contributions is precluded, and with it the idea of a moral community bound by ties of solidarity disappears. The charge that nonhuman animals are being used as resources gains in force.

But the rhetorical question points to a more radical departure from contemporary experimental practice, and toward a response to the deepest challenge to experimentation on animals. Perhaps some people might decide, clearheadedly and after extensive reflection, to offer their bodies—and their brains—for experimentation. At first sight, the idea appears absurd. It can be approached, however, from the perspective on welfare proposed in the previous section. There, I countered concerns that lives of laboratory animals must inevitably be diminished by envisaging ways in which the experimental procedures came at the very end of lengthy lives throughout which the species-typical drives have been satisfied. By the same token, human beings might willingly, even eagerly, agree to the experimental use of their bodies during the terminal stages of their lives.

The arrangement I imagine is the further development of three contemporary practices now welcomed by a significant number of people. The first of these allows us to declare in advance that, after our deaths, parts of our bodies may be transplanted into living bodies that need them. The second is the willingness, sometimes the eagerness, of those suffering from terminal diseases to try out drugs whose effectiveness and whose safety have not been confirmed. The third permits people to draw up and sign legally binding documents that under certain types of conditions—typically those in which standard psychological functioning has been irremediably destroyed—ask for the removal of life support. Many of those who are glad to have this third possibility are motivated by horror at the prospect of ending their lives in a condition where they can no longer think. I belong to this group. For me, the prospect of dementia is far worse than the thought of death.

That prospect changes, however, when I imagine my demented body kept alive just a little longer, long enough for responsible scientific researchers to probe it in any ways that are useful for them. I add the proviso that the procedures they will carry out are compatible with the management of pain, and I trust them to deliver the appropriate analgesics. As I envisage this scenario, I am comforted by the idea of a new adaptation of my life, when my body and brain are no longer able to engage in the activities I have found valuable—I am redeemed from a hopelessly dysfunctional state through being pointed in a new and worthwhile direction. Just as I am heartened by imagining another person benefiting from one of my kidneys or from my retina, I would be

glad to be part of a broader project in which my decayed existence would have some chance of contributing to the health of others (including the health of nonhuman animals).

There are complications, of course. Any practice of voluntarily contributing one's body to future research would have to guard against potential abuses, and would depend on the agreement of those who would be most affected by the volunteer's death (and the manner of it). People who might want to contribute their bodies to science in this way should precede drawing up any analogue of a living will with an extensive series of conversations with their loved ones. Further, acting on the will would have to be sensitive to epistemological concerns that we cannot always judge when the capacity for intelligent thought has departed.[24] It would also have to cope with the possibility of a change in attitude between the time of framing the original intention (signing a "will" bequeathing the demented body to science) and the time at which dementia sets in. The earlier self should not be allowed to practice tyranny, condemning a later self to undergo procedures it now finds horrifying.

Such complications are not new. Old people need protection against coerced medical decisions of many kinds. Procedures to ensure that relatives of patients are consulted are routine in many medical settings. With respect to changes of heart, both in the case of living wills and for the extension of the practice I am envisaging, the problem can be alleviated, if not entirely overcome, by requirements that consent be renewed at regular intervals. Concerns about whether the apparent psychological decay is real are probably the most difficult to address. Yet we can imagine that the diagnostic uncertainties are explicitly part of the process. Those intending to sign a living will or to allow their decayed bodies to be used in experiments could be informed of the known limits of diagnosis, allowed to specify what procedural conditions should

24. Patients with locked-in syndrome have often been taken to be in vegetative states until someone (usually a family member) recognizes a pattern to their eye movements. The thought that someone might be in a state of this kind, apparently demented but nonetheless cognitively intact, might be taken to block any decision to realize the person's prior intention to be used as an experimental subject—or equally to proceed with an earlier demand for death under the conditions apparently prevailing (expressed in a living will). Despite the fact that diagnoses of the syndrome are now made more reliably (and can be ruled out under a range of neural conditions), locked-in syndrome can be viewed as pointing to a terrifying spectrum of possibilities that ought to constrain treatment.

attend the realization of their expressed wish. People who decided to go ahead, recognizing a tiny risk of misdiagnosis, might even be seen as all the more thoroughly committed to the cooperative project of the moral community.

In principle, the development I am imagining might induce a reconceptualization of human death and of the stages that immediately precede it. Viewing ourselves as turning a useless, often costly phase of human existence into something that might express solidarity with a moral community could bring a form of consolation.[25] It might also lend an entirely new Gestalt to certain types of laboratory procedures, bestowing on them the solemnity and the celebration aimed for in attempts to honor the departed.

Were such attitudes to become common, the practice of human experimentation might (legitimately?) extend further. People who have done terrible things they deeply regret might wish to offer themselves by way of atonement; parents of children with devastating genetic diseases might even recognize ways of conferring meaning on blighted lives. We can imagine a completely healthy prisoner, sentenced for life, who becomes horrified by what he has done, and who requests the opportunity for a chance to contribute to the alleviation of future human suffering (or even nonhuman animal suffering) as an expression of remorse. His resolve remains constant, under months of probing discussion and even when he is temporarily transferred to a more benign prison environment. Under these circumstances, an oversight committee might deliberate the issue—and permit him to make the sacrifice.

From a Darwinian perspective, the emergence of our species has not only led to radical changes in the environments of many other animals, but has also produced a species able to reflect on those changes and on the selection pressures they generate. Legislating for the entire animal kingdom is too vast an enterprise for us to attempt it, but our species could work to fashion a broader moral community, creating an enclave in which human beings are bound by ties of solidarity to some nonhuman animals (particularly those we have brought into being through

25. The idea of consolation from seeing oneself as part of a larger community and a project that endures beyond one's own life is developed further in chapter 4 of my *Life after Faith* (New Haven, Conn.: Yale University Press, 2014). It is also akin to ideas brilliantly elaborated in Samuel Scheffler, *Death and the Afterlife* (New York: Oxford University Press, 2013).

domestication), and in which they and we share in contributing to common projects. Our nonhuman "fellow-citizens" cannot, of course, agree to the sacrifices we ask of them. Oversight committees might ask if that is so morally disturbing, in a world in which people are prepared to make analogous sacrifices of ourselves. Animal experimentation acquires a new face when some of the animals are human volunteers. It would appear even more different in a future world in which volunteering became regarded as the decent—the humane—thing to do. The animals cannot consent. But perhaps we pay them a compliment by supposing that, if they were to undergo the process of development Darwin envisages as inevitably producing a moral sense, they would act as selflessly as the volunteers do.

Doubts may linger. Can the willingness of some human beings (possibly only an odd few) justify a policy of *forcing* animals to suffer a *terrifying, painful, or demeaning* termination of their lives? The question requires a two-stage answer to address both foci of concern. First, the attempt at solidarity is assumed to be set within the frame I have already proposed: laboratory animals enjoy a relatively long life in an environment responsive to their needs; their deaths are preceded by providing drugs to manage pain and prevent fear. Of course, some of them may lose normal capacities and consequently behave clumsily. But the loss of grace should not be seen as in any way demeaning. Human subjects who offered their demented bodies for experimentation would rightly foresee their postexperimental ineptness as giving meaning to an otherwise degraded state—the cognitive wreckage takes on a point through its contribution to a larger biomedical project. Mocking misshapen or clumsy animals would be a blind and callous failure to appreciate their similar contribution.

The second charge—that animal experimentation is inevitably a form of coercive exploitation—requires me to synthesize points made throughout this article. To continue the ethical project is to engage in a conversation aimed at legislating with respect to the problematic situations we face. Human beings cannot dodge the issue of legislating for the living world. A decision to leave the pressures of natural selection as they would have been in our absence (to the extent that that is possible) would already be an ethical decision, one affecting the lives of many animals. We routinely eradicate disease vectors, and our strategies sometimes involve increasing the mortality rate among their obligate—

sentient—hosts. Our practice causes some animals to die prematurely, and others (many, many more) to live and thrive. The best candidates for justified animal experiments are similar in this respect.

Yet we need not treat experimental animals as mere tools for decreasing aggregate suffering. Oversight committees should contain people who speak for the potential animal subjects. Should those representatives concede that, if the animals enjoy long and comfortable lives, a final short period of artificially modified existence can be permitted? There are obvious precedents for doing so. With respect to infants, developmentally disrupted children, the demented, and the unborn, we set up institutions and constraints that affect (and sometimes confine) their lives. Historically, many countries have demanded that young adults spend some period of their lives in national service (not necessarily military service). At their best, these policies provide opportunities for a valuable life, while requiring (without the consent of the new citizens) that a small part of it be devoted to achieving some large social good.

I propose that people have the opportunity to permit experiments on the bodies that may one day house their shattered minds. The proposal might yield a new perspective on the legislative discussion. If some human beings were willing—and eager—to accept a similar end to the termination envisaged for the animal subjects, it would show that the life pattern conceived for the animals is a worthwhile—even a noble—way to live and die. Recognizing its value would support a legislative decision to allow a (carefully managed) practice of animal experimentation.

Recruiting, even designing, animals for laboratory life and death need not be a form of enslavement. Although we act without their consent, we may take great pains to ensure that almost all stages of their lives go as well as possible. My proposal is that human beings and nonhuman animals join in a cooperative venture. How that venture is worked out in detail is for inclusive, informed, and empathetic committees to decide.

The kind of cooperation and solidarity I have envisaged may still seem a romantic fantasy (or a gothic horror?), but it is already prefigured in the attitudes of some people. The example of Banting and Best is, understandably, familiar to many diabetics and to members of their families. As they reflect on it, people in these groups are often moved to

praise the "heroism" of the dogs who suffered and died in the summer of 1921.[26]

It would be disingenuous to close this article without confessing my own reasons for joining the chorus. A year after the experiments were performed, my mother, then in her early teens, was diagnosed with severe diabetes. She hung on for another year, until insulin became available in Britain (although, even then, deciding just what dosage to supply was a difficult medical problem). I owe my life to Banting and Best—and to their dogs. Offering my demented body for experimental procedures would be a way of partially paying back.

26. See, for example, http://asweetlife.org/jessica-apple/blogs/insulin-pumps/the-dog-behind-banting-and-best-marjorie-my-diabetes-heroine/27404/. My use of quotation marks is prompted by a sense of the difference between dogs who (for example) plunge into burning buildings to retrieve a familiar child and the dogs who died in the diabetes experiment. Much as I understand (and sympathize with) the sentiment behind this post, it seems to me that Marjorie had heroism thrust upon her.