

COMMENTS

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A Dissection of the Chapter "Tools for Research" in Peter Singer's *Animal Liberation* (43958A)

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Abstract. The book *Animal Liberation*, by philosopher Peter Singer, is frequently referred to as the bible of the animal liberation/rights movement (ALARM). Thus, Singer is regarded as a major moral standard-bearer of the ALARM. Some have suggested that his book provides "intellectual rigor" to the moral arguments for animals' equality with humans, which had previously been based largely on emotionalism and sentimentality. We have analyzed the contents of the chapter "Tools for Research," which criticizes the use of animals in biomedical research as well as for drug and for product-safety testing. In order to discredit these practices, Singer "documents" his arguments with 138 "notes," some of which are to the same reference and others of which contain multiple references. Of the 132 different references, we attempted to verify the accuracy of 49 of them. Of these, 16 (33%) were inaccurate or we could not find. In addition, Singer mischaracterizes the cited studies in various ways. He quotes selectively and out of context from numerous research projects. He never mentions the objectives of these projects, except occasionally when, in our opinion, he distorts or trivializes them. Singer also cites supposedly damning "evidence" published by other antivivisectionists, even though this "evidence" has been refuted in the literature.

Singer supposedly embraces utilitarianism, a philosophy which holds that the harm done by a practice should be balanced against the gain realized from it. However, he makes virtually no attempt to consider objectively the benefits that have been realized from animal-based medical research, and he greatly exaggerates the costs. To him, animal research is "all pain and no gain."

We believe that Singer's moral arguments for animal equality are not convincing. The lack of objectivity and the reliance upon distortion and selective quotation that characterize Singer's "scholarship" are surprising when one considers that he presents himself as an ethicist and moralist.

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The publication in 1975 of the first edition of *Animal Liberation* (1), by Australian philosopher Peter Singer, is generally considered to be the spark that reignited the smoldering embers of the relatively quiescent antivivisectionist (AV) movement (2). Although the new antivivisectionists eschew that label in favor of the term animal "rightists" or animal "liberators," and more recently, animal "protectors,"

the neo-AVs use the same arguments and tactics as did their AV predecessors to advance their cause (3). Even Singer acknowledges in the preface to the second edition of his book that “it had all been said before” (4, pviii).

Both editions of *Animal Liberation* condemn most uses of animals by humans, but the bulk of Singer’s attention focuses on their use in biomedical research and for food. Indeed, the chapter “Tools for Research,” which criticizes the use of animals in research and product-safety testing, comprises 28% of the second edition (i.e., 69 pages out of 248), and the chapter that is critical of animal agriculture (“Down on the Factory Farm”) occupies another 25%. The latter chapter has been critiqued by Larry Katz in what we believe to be an appropriately titled analysis (“How to Attack Animal Agriculture with a Pinch of Fact and a Pound of Hyperbole” [5]) and will not be considered by us here.

While we were evaluating the validity of some of Singer’s claims in “Tools for Research,” we found that he makes use of methods that we consider to be those of propagandists to sway readers to his position. Distortions of the truth about the use of animals in research and product-safety testing abound, although in some cases Singer apparently simply reiterates misinformation published previously by other AVs. In an earlier critique of this chapter (6), we presented three examples of Singer’s distortions. Space limitations precluded a more thorough accounting, but we hoped that three examples would serve to illustrate Singer’s methods. In his considerably lengthier reply (6), Singer essentially denied doing what we had shown him to have done and then stated that as we had not specifically cited errors in his other references, particularly his “accounts of the nature of experimentation on animals,” we had given him “reluctant endorsement of the accuracy of this damning material.” We cannot let such an inaccurate statement go unchallenged.

In the present essay, we offer a more thorough (though not exhaustive) “dissection” of the “Tools for Research” chapter in the second edition of *Animal Liberation*. First, some general comments are in order. In analyzing the chapter, we were amazed at the number of citation errors (16 errors in 49 different checked citations) in what is supposedly a scholarly work. We could not find some of Singer’s citations. This problem was compounded by the fact that his list of references (“Notes”) adheres to no standard format and appears haphazard in style. In most cases the authors of a cited source are not given; occasionally a paper title is listed, but usually not. On the occasions that Singer’s reference was obviously in error (e.g., no such volume existed for the given year of a cited journal), it was difficult to determine just whom or what

Singer was citing. A further problem was his failure to cite page numbers for items appearing in newspapers, which necessitated poring through reels of microfilm. We do not believe that this sort of bibliographic nonchalance is common among philosophers in their writings, and we were disappointed to find such poor citation techniques.

The Anatomy of the Chapter—An Overview

Although Singer is a philosopher who has written or coauthored several books, it is our opinion that his chapter on the use of animals in research is neither particularly well written nor tightly reasoned. It is, however, cleverly constructed to appeal to a target audience of impressionable animal lovers or the already true believers in the cult of animalism—giving them many examples of luridly portrayed research in the same tones one might use to describe an ogre under the stairs in a story designed to frighten children. Singer implies or specifically states that essentially all of the research he describes is useless, and he frequently “introduces” the researchers themselves with their workplace addresses, which is interesting considering the paucity of complete references for the chapter. An objective but scientifically naive reader probably would come away from the chapter with the feeling that, while giving animals the same moral consideration one normally extends to humans is not a rational concept, most or all of animal research must be cruel, painful, and useless.

The major topics covered in the chapter are listed in Table I along with their proportionate representation in the chapter’s 69 pages. General criticism of animal research and Singer’s moral arguments against such use constitute the major topics of the chapter (41% of the pages). Criticism of studies on animal behavior and drug addiction comprise about one-quarter of the pages, while the other topics listed receive substantially less attention. Of the 37.5 pages of the chapter that are critical of various uses of animals in research or product-safety testing, almost half are devoted to discussing studies on animal behavior and drug addiction, and about one-fourth focus on product-safety testing in animals. The other two topics receive about 15% each of the total criticism in this category. Although there are no data comparing the number of animals used for various types of experiments, a comparison of the 1993 budgets of the various branches of the major U.S. biomedical research funding agency, the National Institutes of Health, shows that the institutes that fund research on behavior, mental health, and addiction received only about 11% of the total budget, while the institutes that fund research on cancer, diabetes, and heart disease received about 37% of it (7). As the number of animals used in any particular research area is presumably related to the

Table I. Major Subjects Covered and Their Proportionate Representation in Singer's Chapter "Tools for Research"

Topics	No. of pages	Percentage of total	Percentage of pages on animal use
General criticism and moral arguments	28	41	—
Animal behavior and drug addiction	18	26	48
Product testing	8.5	12	23
Research conducted by the military	5.5	8	14.5
Studies on shock and head injuries	5.5	8	14.5
No. of animals used and commercial aspects	3.5	5	—
Total pages	69	100	100

amount of money spent on research in that area, it is clear that Singer's chapter is unbalanced in its presentation. We can guess at the reason, from Singer's perspective, for this disproportionate emphasis. He has chosen to focus on the areas of research that can be most readily presented in a manner generating maximal emotional impact and about which there is widespread ignorance on the part of the public regarding the benefits that have derived from them.

"Tools for Research"—Dissected

Discrediting the U.S. Military. The chapter begins with a description of the 1987 movie, *Project X*, a film about the rescue of chimpanzees from a U.S. Air Force laboratory, where they were to have been used in experiments to determine whether exposure to radiation would affect their ability to control a simulated airplane. According to Singer, the film

gave many Americans their first glimpse into animal experiments carried out by their own armed forces. . . . The plot was fiction but the experiments were not. They were based on experiments that have been conducted over many years at Brooks Air Force Base, in Texas. . . . What happened to the chimpanzees in the film was very much a softened version of what really happens. (4, p25)

What "really happens" at Brooks Air Force Base (A.F.B.) "happens" to rhesus monkeys, not to chimpanzees, but Singer's narrative cleverly obscures this fact. This "error" may seem minor, but most people have a considerably greater concern for chimpanzees than for rhesus monkeys.

Singer next describes, with reasonable accuracy, the procedure used to train monkeys to control a "Primate Equilibrium Platform" (8), which simulates manual control of an aircraft. The training involves *mild* shocks (but Singer omits the adjective) and also positive reinforcement with raisins. Singer implies that monkeys continue to receive shocks until they perform the task at hand, whereas the paper that Singer summarizes (8) refers repeatedly to 10-sec trials. The

shocks themselves were of no greater amplitude than 2–4 mA and of 0.5-sec duration. Such shocks are meant to be irritating, not painful, and investigators routinely test shocking devices on themselves before using them on animals to ensure that they are operating according to specific parameters.

Singer informs his readers:

All this training, thousands of electric shocks, is only preliminary to the real experiment. Once the monkeys are regularly keeping the platform horizontal most of the time, they are exposed to lethal or sublethal doses of radiation or to chemical warfare agents, to see how long they can continue to 'fly' the platform. Then, nauseous and probably vomiting from a fatal dose of radiation, they are forced to try to keep the platform horizontal, and if they fail they receive frequent electric shocks. (4, p27)

Although this admittedly horrific description is essentially correct (except that the shocks do not continue after failure is noted, contrary to Singer's implication), it omits any mention of the *rationale* behind the experiments. Such omission continues throughout the chapter. Singer says not one word about why such experiments might be performed, except to deny their utility for estimating "probable force strength or second strike capability" (in other words, to estimate how human pilots might be able to perform) after a nuclear attack (4, p28). But those estimates, which were deemed to be of paramount importance for national security during the Cold War, were precisely why the experiments were conducted (9).

Singer goes on to describe a similar experiment performed at Brooks A.F.B. (10), except that in this case the investigator tested the effects of prolonged exposure to low doses of the chemical warfare agent soman (an organophosphate nerve gas) instead of radiation. Singer notes that this report was published in 1987 "after *Project X* had been released," implying that the U.S. military was remiss in not ceasing all primate-related research following the release of a Hollywood film. Singer tells us that nerve gas is "a

chemical warfare agent that caused terrible agony to troops in the First World War, but fortunately has been very little used in warfare since then" (4, p27). This is an inaccurate depiction of military history. Nerve gases were not developed until World War II, and they were never used in that war, apparently out of fear of retaliation (11). Since then, however, at least one warlord, Iraq's Saddam Hussein, has used such chemical weapons to kill his own people (Iraqi Kurds), and has stockpiled these chemicals for use in warfare. Singer's chapter predates the Persian Gulf War in 1991, but it is obvious now that the United Nations forces fighting Hussein in that conflict may have needed the data on soman that were collected in the Brooks experiments, particularly those in which antidotes to the poison were tested (10). The U.S. military was not engaging in useless research, as Singer implies. Had they been testing the chlorine or mustard gases used during World War I and since discarded, he might have had a point.

On page 29, Singer comes to the passage that opened the chapter in the first edition (1), a description of then-Representative Les Aspin's reaction in 1973 to "an advertisement in an [unnamed] obscure newspaper" that the U.S. Air Force planned to purchase beagle puppies "for tests of poisonous gases." According to Singer, "Aspin began a vigorous protest, supported by antivivisection societies," and the subsequent outpouring of critical mail "from an outraged public" caused the Department of Defense to announce that "it was looking into the possibility of replacing the beagles with other animals" (4, p29).

We were unable to verify the accuracy of this account. Singer's reference for this information (4, Note number 5, p272) reads: "*Air Force Times*, November 28, 1973; *The New York Times*, November 14, 1973." A thorough search of that issue of *The New York Times* turned up no such article. An article in the November 28 issue of the *Air Force Times*, entitled "Gas testing of dogs draws huge outcry" (12), did not explain how Aspin got word of the planned experiments, nor did it suggest that the Department of Defense was "looking into the possibility of replacing the beagles with other animals." It did report that a huge outpouring of mail was "apparently spurred by an ad taken in dozens of newspapers by the Anti-Vivisection Society," an advertisement that misrepresented the proposed military research. According to the *Air Force*, the dogs were to be used "to determine the long-time safe exposure limits for Air Force people who may be exposed to rocket propellants, jet fuels, [and] fire extinguishants. . . . The animals are NOT used to test poison gas" (emphasis in the original). The article also quoted from some of the angry letters: "Don't use beagles, use congressmen!"; "Use the people who thought this experiment up"; "Use the 300 American

deserters in Sweden." A House Armed Services Committee aide was quoted as saying he felt that the heavy volume of mail on beagles "showed a strange sense of priorities" (12).

Singer goes on:

All this amounted to a curious incident—curious because the public furor over this particular experiment implied a remarkable ignorance of the nature of standard experiments performed by the armed services, research establishments, universities, and commercial firms of many different kinds. True, the proposed air force and army experiments *were designed so that many animals would suffer and die without any certainty that this suffering and death would save a single human life or benefit humans in any way at all; but the same can be said of millions of other experiments performed each year in the United States alone.* (4, p29, emphasis added)

This statement by Singer is interesting for several reasons. First, it betrays the fact that although Singer apparently knew from the article in the *Air Force Times* to which he refers what information the military intended to gain from the experiments with the beagles, he reiterated the misinformation presented by antivivisectionists. Second, we believe that the paragraph above illustrates an anti-American sentiment that appears regularly throughout Singer's entire book. Third, it contains unsubstantiated implications about the kinds of research done at various nonmilitary U.S. institutions, specifically that experiments comparable to those described using beagles and poisonous gases are "standard" at our universities and other research establishments. Fourth, Singer states that the experiments were "*designed so that many animals would suffer and die*" (emphasis added). Fifth, it makes the tacit assertion that experiments involving animals are particularly heinous if there is no *certainty*, before the experiments are performed, that they will benefit humans (although there was clearly a hope in this case that they would benefit U.S. service personnel). Of course, a fact of experimental science is that we do not know the answer before we do the experiment, nor can we know in advance what it is we need to know. Finally, Singer's mention of "millions of other experiments" is interesting because, in his 1975 edition, he spoke of "tens of thousands" (1, p28), implying a marked increase in the number of experiments using animals.

The most reliable data on animal use over the 15-year period between the first and second editions of Singer's book show that the total number of animals (excluding rodents) used in federal government facilities declined by 53% from 1978 to 1983 (13, p51). It is

likely that a similar decline occurred in nongovernment facilities as well. The best estimate of the total number of animals, including rodents, birds, amphibians, and fish, used in U.S. laboratories in 1986 is between 17 and 22 million (13, p64). Thus, there is no evidence to support Singer's hyperbolic and undocumented implication that the number of animal experiments has increased more than 10- to 100-fold between 1975 and 1990; nor is it likely that millions of animal experiments of any sort, much less those "designed so that many animals would suffer and die," are performed in the U.S. each year.

Singer next describes another military experiment using beagles, for which he again gives no rationale, then comments, "In any case, it is wrong to limit our concern to dogs. . . . If the army were to stop experimenting on dogs and switch to rats instead, we should not be any less concerned" (4, p30). Singer seems to forget that he has spent most of the chapter so far on experiments with monkeys, which account for less than one-half of one percent of the mammals used in research. In any case, instead of turning his attention to rats, Singer goes back to more radiation experiments on monkeys, this time at the Armed Forces Radiobiology Research Institute in Bethesda, MD. There, Singer claims without giving any references, monkeys are "tied . . . down in chairs and irradiated" (4, p30). He then describes a monkey irradiation experiment similar to those done at Brooks A.F.B., except that the behavioral deficits studied involved physical activity in a treadmill-like wheel (14). Singer's description again concentrates on the suffering that results from irradiation, without, of course, any mention of why anyone might want to know how physical activity, compared with the coordination performance parameters studied at Brooks, might be compromised by radiation. Singer notes that if a monkey after irradiation

did not move the wheel for one minute, "shock intensity was increased to 10 mA." (This is an extremely intense electric shock, even by the quite excessive standards of American animal experimentation; it must cause very severe pain.) (4, p31, emphasis added)

Singer thus takes advantage of an opportunity to be critical of U.S. research, but he also shows his knowledge of physics and sensory perception to be limited. The intensity of the perception of electrical shocks depends upon the amount of energy (i.e., the number of coulombs) delivered, which is a function of amperage, voltage, duration, and area of the stimulated surface. The only parameters of the shocks given in this particular paper (14) were the amperage and duration (0.4 sec). It is impossible to determine how this shock

intensity would be perceived even by a human subject without information on the voltage and the surface area of the electrodes. For example, a static electric carpet shock, which is very brief and highly focused, carries about 60 mA of current at about 1000 V. Such static shocks are generally irritating, but not particularly painful. If the same shock were delivered over an area of 1 cm², it would barely be perceived. Causing "very severe pain" to an animal would be counterproductive to the goals of most experiments, including the one Singer is, in our opinion, mischaracterizing here. Shock is used to motivate performance of a task, not to debilitate (or torture) the animal subject.

Up to here, then, Singer has taken six and one-half pages (almost ten percent of the chapter) to examine in some detail five studies performed by the U.S. military. In no case is the purpose of the experiments stated, except in one case to deny the validity of the purpose (4, p28). At this point, Singer tells us:

We should not, of course, judge all animal experimentation by the experiments I have just described. . . . Genuine scientific research, surely, will be very different, won't it? We shall see. (4, p31)

We do not believe that Singer has given the reader enough information to determine whether the military research he has described is "genuine." If genuine research is that which can be reasonably expected to provide potentially useful or important information about a testable hypothesis, then in our opinion, these experiments qualify. But in order to make that judgment, we had to read the actual papers ourselves.

Harassing Harry Harlow. At this point, Singer begins his "examination of nonmilitary scientific research" by introducing the reader to the late Harry F. Harlow. Singer graciously states that he "shall allow [Harlow] to speak for himself" (4, p31). However, Singer does not "allow" Harlow to explain the rationale for any of his work, and he quotes selectively from Harlow's studies of maternal separation and social isolation in monkeys for maximum emotional effect. To begin, he quotes from a 1965 paper from Harlow's laboratory, entitled "Total Social Isolation in Monkeys" (15):

For the past ten years we have studied the effects of partial social isolation by raising monkeys from birth onward in bare wire cages. . . . These monkeys suffer total maternal deprivation. . . . [Singer omits: "and, even more important, have no opportunity to form affectional ties with their peers." The importance of peer bonding for normal social development in monkeys is one of several significant findings gleaned from research in Harlow's laboratory.]

More recently, we have initiated a series of studies on the effects of *total* social isolation by housing monkeys from a few hours after birth until 3, 6, or 12 months of age in [a] stainless steel chamber. . . . During the prescribed sentence in this apparatus, the monkey has no contact with any animal, human or subhuman. (4, pp31–32) [Some corrections were made to Singer's quote to make it conform to the original (15, p90).]

This quote, taken by itself, is stark and nonexplanatory. For example, although "bare wire cages" sound cruel, Harlow showed that wire is not bothersome to monkeys (16), and wire was used for the earlier studies so that the monkeys could see each other. Thus, the social isolation was only partial in those studies. Even more unfairly, Singer does not "allow" Harlow to explain why he did the research in the first place. In the paragraphs preceding the quote, Harlow notes that social isolation in humans is "recognized as a problem of vast importance" and that "it is difficult or impossible to study scientifically the impacts of culturally produced social isolation at the human level." Thus, his laboratory developed a monkey model for this condition in order to "find insights into the problems created by human social isolation from study of social isolation in monkeys" (15, p90).

Singer also fails to mention any of the clinically important observations Harlow and his colleagues reported in that paper, including the fact that the effects of three months of social isolation were reversible—"in human terms they are the children salvaged from the orphanage or inadequate home within the first year of life"—while "isolation extending through the first 6 months of life . . . severely impairs the potentiality for socialization" (15, p92). They also found that the "intellectual mind" of the isolated monkeys was less crippled by the deprivation than was their "social mind" (15, p95).

Singer goes on to describe another article by Harlow and Stephen Suomi (17). Although Singer spends nearly two pages quoting from this article, the impression he conveys is not, in our opinion, accurate. According to Singer, Harlow and Suomi

described how they were trying to induce psychopathology in infant monkeys by a technique that appeared not to be working. They were then visited by John Bowlby, a British psychiatrist. . . . Bowlby listened to the story of their troubles and then toured the Wisconsin laboratory. After he had seen the monkeys individually housed in bare wire cages he asked, "Why are you trying to produce psychopathology in monkeys? You already have

more psychopathological monkeys in the laboratory than have ever been seen on the face of the earth." (4, p32)

Singer writes in horror about how the researchers were trying to induce depression in infant monkeys by giving them "monsters" for mothers, either cloth surrogates that could be fashioned to be inhospitable to the infants, or real mothers that abused or even killed their infants. Singer fails to point out that it was this "monster mother" technique that was not working to produce psychopathologies in Harlow's monkeys. The infants that survived their hostile parenting were normal, provided that they were allowed access to *some* sort of mother and to their peers. It was the social isolates, which were housed "in bare wire cages," that exhibited the symptoms of depression recognized by Bowlby.

As Harlow and Suomi's paper (17) makes clear (but Singer's account of it does not), young animals were originally housed in partial social isolation so that they could form the nucleus of a disease-free breeding colony. At that time, nothing was known about how monkeys would react to isolation, and certainly no one knew that the animals that were raised in this way would be incapable of normal sexual behavior as adults. Harlow wanted to determine how female monkeys raised in isolation might behave as mothers, but he had to devise a means of impregnating them, to which he gave the unfortunate name, "rape rack." Harlow found that these females did indeed become "monster" mothers, but he also made the important discovery, unmentioned by Singer, that when such mothers did not kill their infants, they were actually rehabilitated by them, and had normal relations with their infants from later pregnancies. This unexpected result gave Harlow and Suomi the idea of trying to use normal, younger monkeys as "therapists" for other animals that had been severely socially impaired by 6 months of social isolation—and the treatment was successful! This finding has led to treatments for human psychosocial disorders, including autism (18).

Harlow and Suomi (17) also outlined the long-term goals for their animal model of depression, which included the testing of drugs and other rehabilitative therapies, and determining which qualities, characteristics, or early experiences might put an individual either at greater or lesser risk for developing depression. This work is described more fully in a review (19).

Going back to the quote of John Bowlby: Singer's description seems to indicate that Bowlby ("a leading researcher on the consequences of [human] maternal deprivation" [4, p32]) was critical of Harlow's use of animals. Indeed, in his chapter, Singer follows the quote he took from Harlow's paper (17) with another

quote from Bowlby, this time from a book the British psychiatrist had written in 1951 (20), “before Harlow even began his research on nonhuman primates”:

The evidence has been reviewed. [Here Singer omits ellipsis dots, and he also omits the ending of the sentence: “. . . at some length because much of it is little known and the issue of whether deprivation causes psychiatric disturbance is still discussed as though it were an open question.”] It is submitted that evidence is now such that it leaves no room for doubt regarding the general proposition that the prolonged deprivation of the young child of maternal care may have grave and far-reaching effects on his character and so on the whole of his future life. (20, p46, as quoted in 4, p32)

Singer then remarks: “This did not deter Harlow and his colleagues from devising and carrying out their monkey experiments.”

This passage, as “edited” by Singer, suggests that Bowlby would view as useless an animal model for a condition that was well understood in humans. This is not the case, however, as could be seen if Singer had quoted more extensively to allow the reader a more complete picture of Bowlby’s intent:

However that may be, although the main proposition may be regarded as established, *knowledge of details remains deplorably small. It is as though it had been established that an absence of vitamin D caused rickets and that calcium was in some way involved, but as yet no quantitative measures were available and there was complete ignorance of the many interrelated associated factors.* (20, p46, emphasis added)

This comment gets to the heart of the issue of why research is done on animals. The vast majority of humans in virtually every culture would agree that one cannot ethically tease apart the many complex “inter-related associated factors” of the response to maternal deprivation using humans as experimental subjects. Bowlby himself acknowledged this fact later in the same book in a chapter entitled “Research into Effects of Deprivation,” wherein he summarized the areas in which more knowledge was needed and the problems associated with gathering that information. Bowlby commented: “Fortunately, the problems both of sampling and of access are absent if we use animals as our experimental subjects,” and mentioned, with approval, some early work with goats (20, p61). In a later book on attachment and loss (21), Bowlby devoted a chapter to observations on nonhuman primates because, as he explained, he recognized the similarities

between their attachment behavior and that of young humans, and because he appreciated the value of insights that can be gained from controlled studies on animals in the laboratory.

Compared with Bowlby’s example of acquiring knowledge of the details of calcium metabolism (which, of course, also involved animal research), arriving at a clear understanding of the important facets of developmental psychology will obviously be much harder. But progress is being made. The rationale for studies on the effects of maternal separation on non-human primates has been well summarized by Reite and Short in a review (22).

Hounding Harlow’s Colleagues. Singer comments: “Harlow is now dead, but his students and admirers have spread across the United States and continue to perform experiments in a similar vein” (4, pp34–35). Singer refers to primate researchers W. A. Mason and Gene Sackett as students of Harlow, but they were not. As Sackett remarks in a review (23) of a book about maternal deprivation experiments that was written by antivivisectionist Martin L. Stephens (24), this mistake about “an inbred line of researchers nurtured by Harlow” is “an item of minor importance [that] illustrates poor scholarship and bias” (23, p24).

Singer also copies Stephens’ misrepresentation of the significance of Sackett’s studies on social isolation in different species of monkeys (25). Singer informs the reader that Sackett

found differences among the different monkey species which “question the generality of the ‘isolation syndrome’ across primate species.” If there are differences even among closely related species of monkeys, generalizations from monkeys to humans must be far more questionable. (4, p35)

In his review, Sackett responds to similar criticism from Stephens (24) thus:

Individual differences in response to identical etiologies and therapies are a usual outcome in human behavior disorder research. Understanding the genetic, environmental, and social compensatory sources of this variability is a critical clinical need. . . . In my view, this variability validates animal models by demonstrating their basic concordance with human findings. Studying the complex causes of individual differences is a major role for animal models of preventing and treating human disorders—a role completely misunderstood in this monograph [by Stephens]. (23, pp24–25)

Singer next criticizes Martin Reite for conducting so-

cial isolation experiments on chimpanzees (26) even though Reite "was aware that Jane Goodall's observations of orphaned wild chimpanzees described 'profound behavioral disturbances, with sadness or depressive affective changes as major components.' " Singer claims that Reite and his colleagues

experimented on chimpanzees because relatively little experimental work had been done on the great apes, as compared with monkeys. They apparently felt no need to address the basic question of why we should be doing any experiments on maternal deprivation in animals at all. *They did not even try to justify their experiments by claiming they were of benefit to human beings.* (4, p36, emphasis added)

This is a remarkable comment. First, it is true that little experimental work had been done on our nearest relatives—and because they *are* our nearest relatives, that would seem to be good reason to investigate their behavioral and physiological reactions to various circumstances, including peer separation. Observations of animals living in the wild are of interest, but as with studies using humans, there are too many confounding variables present in such studies to allow a clear understanding of complex phenomena. Second, the paper in question begins:

Maternal separation experiments in macaque monkeys have proven to be a valuable animal model system for studying the effects of the disruption of attachment bonds, loss of mothering, and modeling certain aspects of loss-related affective disorders. . . . The usefulness of such animal model systems of relevance to man is in part a function of the ability to extrapolate from one species to another. (26, p78)

In the next paragraph, the authors review what was known at the time about the responses of chimpanzees to separation of various kinds (these responses were variable from study to study) and compare them with human reactions. The "justification" of the experiment was thus tacitly expressed, and we believe should be obvious to anyone who might read the paper with an open mind. Furthermore, the authors cite two review articles that deal at length with the potential of such studies to benefit human beings (22, 27).

Demonizing the American Scientist. At this point Singer bemoans the amount of taxpayers' money "wasted" on animal research and the number of animals used in the United States and elsewhere. After a page and a half of this complaint, he brings up the business aspect of selling animals and animal research

equipment, quoting from catalogues advertising hairless guinea pigs, "surgically altered research animals," and special equipment such as a "Convulsion Meter," "Rodent Restraint Cones," "Decapitators for both small and large animals," and a "Rodent Emulsifier." Singer warns ominously:

Presumably corporations would not bother to manufacture and advertise such equipment unless they expected considerable sales. And the items are not going to be bought unless they are going to be used. (4, p39)

Then more hyperbole: "Among the tens of millions of experiments performed, only a few can possibly be regarded as contributing to important medical research" (4, p40). Here Singer points out that presumably useless research with "huge numbers of animals" is conducted "in university departments such as forestry and psychology," and that many more are used "for commercial purposes" or for testing "inessential items." Singer gives no references for any of these statements. He goes on:

[W]e need to know more about the experiments that are now being performed and have been performed for a century. Then we will be able to assess the claim by defenders of the present situation that experiments on animals are done only for important purposes. The following pages, therefore, describe some experiments on animals. . . . The reports that follow are all drawn from accounts written by the experimenters themselves. . . .

Such accounts are inevitably more favorable to the experimenters than reports by an outside observer would be. . . . The experimenters will not emphasize the suffering inflicted. . . . Most suffering therefore goes unreported. . . . [S]cientific journals . . . include only those experiments that the experimenters and editors of the journals consider significant. A British government committee found that only about one quarter of experiments on animals ever found their way into print [He cites a chapter by an antivivisectionist (28) as the source of this "information," but that chapter gives no reference to the original "source"]. There is no reason to believe that accounts of a higher proportion of experiments are published in the United States; indeed, *since the proportion of minor colleges with researchers of lesser talents is much higher in the United States than in Britain, it seems probable that an even smaller proportion of experiments yield results of any significance at all* [emphasis added].

So in reading the following pages bear in mind that they are drawn from sources favorable to the experimenters; and if the results of the experiments do not appear to be of sufficient importance to justify the suffering they caused, remember that these examples are all taken from the small fraction of experiments that editors considered significant enough to publish. One last warning. The reports published in the journals always appear under the names of the experimenters. I have generally retained these names, since I see no reason to protect experimenters behind a cloak of anonymity. (4, pp40–42)

Thus, Singer's account works the reader up to a higher plane of anger and outrage while again exhibiting his contempt for U.S. scientists and scholars. Even though he refers over and over to his claim that the examples he cites are "favorable to the experimenters," what follows is simply more of the same kind of distortions as we have seen earlier in the chapter: selected snippets of descriptions of research—again, much of it in the areas of psychology and behavior—taken out of context, with no explanation of why the research was done except to trivialize that intent. The conclusions reached by the researchers, if mentioned, are, in our opinion, generally presented in a misleading manner, with emphasis on aspects of the research that remain unclear. As with the military experiments and the social deprivation studies described earlier, no naive reader could reach any meaningful conclusion about whether such research was conducted "for important purposes" from Singer's descriptions. In the interest of space, we shall consider only a few examples from the rest of Singer's chapter.

It's Simply Shocking. Singer spends the next eight pages criticizing and, in our opinion, mischaracterizing some 15 experiments in which electric shock was used for various purposes. For example, Singer decries a study on retrograde amnesia by Curt Spanis and Larry Squire (29), saying it "is simply an attempt to show that results already known to occur in humans also apply to mice" (4, p43). This is an excellent example of how Singer misleads readers about why animal research is done. As Spanis and Squire point out, results from earlier studies on the time course of memory consolidation in laboratory animals had been difficult to reconcile with clinical data from humans who had received electroconvulsive shock (ECS) therapy. The human patients showed retrograde amnesia over a considerably longer period than did the animals. This discrepancy was troubling because it suggested that there may be fundamental differences in how humans and other animals lay down long-term memory. Spanis and Squire showed that if ECS were given to mice in

the same manner as it is given therapeutically to humans, the mice would exhibit long-term memory losses, equivalent to the results in humans (29). This is an obviously important finding because it means that research on the mechanisms of learning and memory consolidation in animals has relevance for humans.

Singer also incorrectly criticizes a paper by Susan Mineka and colleagues (30) that calls attention to a novel explanation for the differences seen in fear responses after a series of either escapable or inescapable shocks. The authors suggest that when an animal receives feedback—that is, knowledge that something has been done to terminate an aversive stimulus—it may play an important role in ameliorating the animal's fear, quite apart from the issue of "being in control" or "having no control," which was regarded to be the primary variable by most psychologists. Singer quotes only one of the authors' several conclusions about their data: "[T]hey raise some question about the validity of the conclusions of the hundreds of experiments conducted over the past 15 years or so" (4, p45). Singer goes on to, in our opinion, misportray this conclusion:

In other words, fifteen years of giving electric shocks to animals may not have produced valid results. But in the bizarre world of psychological animal experiments, this finding serves as justification for yet more experiments giving inescapable electric shock to yet more animals so that "valid" results can finally be produced—and remember, these "valid results" will still only apply to the behavior of trapped animals subjected to inescapable electric shock. (4, p45)

Thus, Singer again shows either an ignorance of science, or comments inaccurately in describing it. He confuses "conclusions" with "results" (the results of an experiment may well be valid, while the conclusions drawn from them are not, but conclusions are subject to change without necessarily repeating the experiment) and he ignores the accepted premise behind all these experiments, which is that determining the physiological mechanisms underlying the psychological manifestations of fear, anxiety, and stress may be of significant benefit to humans and animals.

At this point, Singer launches into a diatribe against experimenters designed to induce "learned helplessness" as a model of depression. In this model, an animal is given inescapable shocks and is then tested in a situation in which shocks can be avoided by escaping. A naive animal quickly learns to avoid the aversive stimulus, but the "helpless" animal does not, exhibiting behavior strongly suggestive of depression. On page 46 of his chapter, Singer quotes at length from a paper by Martin Seligman, Steven Maier, and James

Geer (31), describing the reactions of dogs to shock. Not surprisingly, Singer does not give the title of the paper ("Alleviation of Learned Helplessness in the Dog," emphasis added) nor does he report the purpose of the study, which was to investigate therapies for learned helplessness. In this report, the authors found that encouraging or forcing "helpless" animals to make a response that terminated the shock alleviated the helpless behavior. In an earlier paper (32, cited in 31), Seligman and Maier showed that animals could be "immunized" against helplessness by prior exposure to a situation in which they had control and could avoid the aversive stimulus. In an autobiographical account of these studies, Seligman writes:

Steve Maier and I had now found out how to produce learned helplessness. But, having caused it, could we cure it?

We took a group of dogs that had been taught to be helpless, and we dragged those poor, reluctant animals back and forth across the shuttlebox, over the barrier and back again, until they began to move under their own steam and came to see that their own actions worked. Once they did, the cure was one hundred percent and permanent.

We worked on prevention and discovered a phenomenon we called "immunization"; Learning beforehand that responding matters actually prevents learned helplessness. We even found that dogs taught this mastery as puppies were immunized to learned helplessness all their lives. The implications of that, for human beings, were thrilling. (33, p28)

Readers of Seligman's book will learn a great deal about how and why animal research is done in the field of psychology, and will also be privy to an irony: Seligman, whose undergraduate major was in philosophy, had qualms about the ethics of animal research himself. He overcame his reservations because he was convinced that only through well-controlled experiments using animals could causes and cures for emotional illnesses be found.

On page 47 of his chapter, Singer's selective quoting from a review on learned helplessness by Maier distorts the intended meaning of Maier's writing:

It can be argued that there is not enough agreement about the characteristics, neurobiology, induction, and prevention/cure of depression to make such comparison meaningful. . . . It would thus appear unlikely that learned helplessness is a model of depression in any general sense. (34, p443 as quoted in 4, p47)

Singer goes on:

Although Maier tries to salvage something from this dismaying conclusion by saying that learned helplessness may constitute a model not of depression but of "stress and coping," he has effectively admitted that more than thirty years of animal experimentation have been a waste of time and of substantial amounts of taxpayers' money. (4, p47)

As we pointed out in our earlier critique (6), Singer's use of ellipsis dots misleads the reader as to the meaning of Maier's complete statement. In his 1984 review (34), Maier summarized what was known at that time about learned helplessness so that a comparison could be made with clinical depression using the four criteria—characteristics, neurobiology, induction, and prevention/cure—that are accepted for assessing whether an animal model successfully mimics a human psychopathology. From Maier's words, even as they were quoted by Singer, it is apparent that it is *human depression* that is difficult to pigeonhole, because it is not a simple, single entity and it has more than one cause, more than one form of treatment, and so on. As Maier points out in one of the sentences Singer deletes, "Indeed, it has been argued that depression itself would not meet a rigorous application of the above criteria." In other words, human depression is not an adequate model for all forms of human depression. Maier goes on in the section that Singer deleted:

There may be many "routes" to what is labelled as depression, and they may not reduce to a single type, even on a conceptual level. It would thus appear unlikely that learned helplessness is a model of depression in any general sense. *However, animal "models" seem useful precisely because they do not duplicate the full clinical phenomenon but can allow the study of a single "route" in isolation.* (34, p443, emphasis added)

Maier notes that one such "route" of depression is the stress that is associated with the inability to cope with a threatening event—in other words, human helplessness, which is what Seligman referred to—and that the learned helplessness model can be used to study it. (Recall that Harlow and his colleagues had studied another "route" to depression—that resulting from social isolation [19]). Moreover, Maier points out that "learned helplessness will not be specific to depression and will have relationships with other conditions in which stress and coping are important" (34, p444). Thus, Maier "effectively admitted" that the learned helplessness model can be usefully applied to some kinds of human depression as well as to other pathol-

ogies involving stress and coping, not, as Singer implies, that it is waste of time and money.

Singer concludes his “discussion” of shock research by reporting on experiments done by “a unit calling itself the Bureau of Child Research [that] has been inflicting electric shock on a variety of animals” (4, p49). This “unit” is actually the Laboratory of Comparative Hearing, which happens to be associated with the Bureau of Child Research at the University of Kansas. This laboratory, as its name implies, does research on the comparative physiology and evolution of hearing. In the experiments cited by Singer (35, 36), the investigators used mild shocks and other strategies to assess the ability of horses to localize sound, which turns out to be considerably less accurate than that of other mammals studied. Although Singer, predictably, derides the studies (“It is not easy to see how this research is going to benefit children”), the authors say they “shed some light on the selective pressures involved in the evolution of hearing” (35, p552). It is not surprising that Singer, with his anti-science bias, sees no merit to having light shed in this area.

Singer summarizes the experiments on shock by saying, “despite the suffering the animals have gone through, the results obtained, even as reported by the experimenters themselves, are trivial, obvious, or meaningless” (4, p49). In our opinion, none of the papers that we read fit any of those categories.

Singer concludes:

[O]ne could fill several books with brief descriptions of yet more kinds of psychological experimentation, such as abnormal behavior, animal models of schizophrenia, animal movements, body maintenance, cognition, communication, predator-prey relations, motivation and emotion, sensation and perception, and sleep, food, and water deprivation. We have considered but a few of the tens of thousands of experiments performed annually in the field of psychology, but they should be enough to show that many, many experiments still being conducted cause great pain to animals and offer no prospect of yielding really momentous or vital new knowledge. (4, p50)

What this tells us is that Singer sees no need for us to have any knowledge at all of neurobiology, behavior, or evolution, and that seeking an understanding that may cure or prevent psychologically crippling diseases—such as schizophrenia, which affects roughly one person in one hundred, or depression, which will strike 15% of the population in the United States and can be so severe that it drives its victims to suicide (18)—is not “vital.” In Singer’s eyes, human suffering apparently counts for nothing.

Singer spends the next two pages telling the

reader, in essence, that psychological experiments with animals have nothing to do with learning about the human mind. He reasserts his anti-science stance by stating:

[M]any of the experiments that are performed on rats can only be explained by assuming that the experimenters really are interested in the behavior of the rat for its own sake, without any thought of learning anything about humans. In that case, though, what possible justification can there be for the infliction of so much suffering? It is certainly not for the benefit of the rat. (4, p52)

Now Singer introduces a central dogma of the animal liberation philosophy—the “you can’t have it both ways” argument: “[E]ither the animal is not like us, in which case there is no reason for performing the experiment; or else the animal is like us, in which case we ought not to perform on the animal an experiment that would be considered outrageous if performed on one of us” (4, p52). This argument is as clever as it is unsound. The fact is that animals are like us in some ways that we can study for potential human benefit and unlike us in other ways that allow for their use by ethical human beings. Moreover, many experiments are done for the sake of learning about an animal’s biology or behavior—knowledge for the sake of knowledge. These experiments, too, may later prove to have relevance for human or animal health or well-being. Singer leads the reader to the conclusion that, no matter which option one picks, animal research is wrong. And this after more than 25 pages emphasizing pain and suffering. Is it any wonder there are armies of anti-research protesters outside our laboratories shouting, “Animal research is scientific fraud” and “Stop all useless psychological research”?

“Poisoning” the Animals: Criticisms of Product Testing and Drug Research. This section begins with the usual hyperbole: “Another major field of experimentation involves the poisoning of millions of animals annually. Often this too is done for trivial reasons” (4, p52). Singer refers to hundreds of thousands of scientific procedures on animals that are done in the U.S. and Britain that “were not related to the testing of medical or veterinary products.” As used here, each “scientific procedure” must refer to each animal that was used to test a product or a drug. Many of these tests are done to determine the potential toxicity of products (such as fertilizers, pesticides, detergents, etc.) that are not intended for therapeutic use in humans or animals. Information on toxicity is necessary for warning labels before such products can be sold.

Singer engages in the common trivialization of product-safety testing, asking, “Should thousands of animals suffer so that a new lipstick or floor wax can

be put on the market? Don't we already have an excess of most of these products?" (4, p53), and then proceeds to misrepresent the kinds of tests that are done today. For example, he introduces the reader to the LD₅₀ test, which determines the dose of a compound that will cause 50% of the animals receiving it to die. After describing the pain and suffering animals experience in this test, Singer says:

The U.S. Congress Office of Technology Assessment has estimated that "several million" animals are used each year for toxicological testing in the United States. No more specific estimates of the LD₅₀ test are available. (4, p54)

Here Singer references the OTA report on Alternatives to Animal Use in Research, Testing, and Education (13, p168). This is a page of summary and conclusions on the use of animals in testing, and it does state that "several million animals" are used—for *all* types of testing, not just the LD₅₀ test, as Singer implies. The LD₅₀ test is not mentioned at all on this page. However, on pp181–182 of the report there is a discussion of criticism of the standard LD₅₀ test and descriptions of alternatives to it that are fast gaining acceptance, such as the approximate lethal dose test and the limit test, both of which use fewer animals than the classic test, and other tests that look at multiple endpoints, rather than lethality. The very precise LD₅₀ test described by Singer is not required by the U.S. Food and Drug Administration (FDA) (37) and is seldom performed now except for drugs that have a high therapeutic dose/lethal dose ratio, such as cytotoxic cancer therapies.

Next on Singer's list is the Draize eye irritancy test. He describes it in horrific terms, quoting from a paper published in 1962, and then says:

Experimenters are not obliged to use anesthetics, but sometimes they will use a small amount of a topical anesthetic when introducing the substance, provided it does not interfere with the test. This does nothing to alleviate the pain that can result after two weeks of having oven cleaner in the eye. (4, p55)

In fact, ophthalmic anesthetics are used whenever possible (38), and the assertion that oven cleaner (or drain cleaner) is tested in animals' eyes is one of the most common distortions of toxicity testing. No substance is tested in the eye until it has been tested for irritancy of the skin, and a substance which is corrosive to the skin will not be tested in the eye. Furthermore, substances with a high pH (such as oven cleaner) or a low pH are known to be corrosive to the skin and need not be tested (13, p154).

Singer goes on to quote a physician as saying:

"The results of these tests cannot be used to predict toxicity or to guide therapy in human exposure" (4, p56). The source of this quote is a newsletter of the Physicians' Committee for Responsible Medicine, an animal rights group that has been strongly criticized by the American Medical Association for misrepresenting the value of animal research for human health and for suggesting that the 97% of practicing physicians in the United States who support the use of animals in biomedical research are irresponsible (39). In contrast, a position paper of the FDA (37) states: "The Draize eye and skin irritancy tests continue to be considered among the most reliable methods currently available for evaluating the safety of a substance introduced into or around the eye or placed on the skin."

In an attempt to further discredit the testing of drugs in animals for potential harmful effects, Singer writes:

Toxicologists have known for a long time that extrapolation from one species to another is a highly risky venture. The most notorious drug to have caused unexpected harm to humans is thalidomide—which was extensively tested on animals before it was released. Even after thalidomide was suspected of causing deformities in humans, laboratory tests on pregnant dogs, cats, rats, monkeys, hamsters, and chickens [sic] all failed to produce deformities. Only when a particular strain of rabbit was tried were deformities produced. (4, p57)

Singer's reference for this statement is: "S. F. Paget, ed., *Methods in Toxicology* (Blackwell Scientific Publications, 1970), pp. 4, 134–139" (4, Note number 57, p276). Page four of the referenced book is part of a chapter by editor G. E. Paget (40), which contains a sentence that has been taken out of context by a number of antivivisectionists, including Singer in his 1975 edition of *Animal Liberation*:

"It is commonly remarked, in fact, that the toxicity tests that had been carefully carried out on thalidomide without exception had demonstrated it to be an almost uniquely safe compound." (1, p53)

The meaning intended by this sentence becomes clear when one adds the unquoted sentences following it in the original:

What was required in this instance, and I think it true to say in many other instances, was not a further proliferation of tests but rather an awareness in those concerned that situations might exist in which hazards might arise that were not covered by the extensive tests they had performed. Such awareness can only arise

when the mind of the investigator is open to the possibility and when individual investigators have sufficient time to consider the whole of the problem rather than being overwhelmed by its numerous and substantial parts. (40, p4)

In other words, the thalidomide disaster occurred because, at that time, investigators did not realize that it is necessary to test in pregnant animals drugs that may be used by pregnant women. Paget is warning toxicologists not to succumb to a false feeling of security that they have demonstrated the safety of a product simply because they have done a prescribed battery of tests on it. He is certainly *not* saying that toxicity tests are worthless.

The other pages (pp134–139) in the book edited by Paget, which Singer cites to support his claim that laboratory tests with thalidomide on pregnant animals “all failed to produce deformities,” are from a chapter entitled “Detection of Teratogenic Actions,” by C. S. Delahunt (41). Contrary to Singer’s statement, this review shows that some investigators *did* report positive evidence implicating thalidomide as a teratogenic agent (after the human tragedy unfolded) using chick embryos, hamsters, and dogs, although other researchers did not confirm these effects. The only study on monkeys reported in this review was unequivocally positive (42). Thus, Singer is again inaccurate in his depiction of a scientific paper.

Singer’s statement about thalidomide is also of interest for what it does not say. The drug was released for human use in Europe, Australia, and Japan, and several other places, as a tranquilizer and as a therapy for pregnancy-associated nausea. The initial report connecting thalidomide with fetal deformities in humans appeared in December of 1961 (43). The first report of the drug causing deformities in any animal species (i.e., rabbits) appeared in the same journal just 4 months later (44). The author of the latter paper, G. F. Somers, noted that in rats, the first animal model he tried, thalidomide caused resorption of fetuses, which is now known to be a warning sign of teratogenicity. The drug was not approved for human use in the United States because Frances Kelsey, then a medical officer in the FDA, was concerned that it had not been tested adequately in animals, particularly pregnant ones (45, pp78–79). Kelsey’s mind was apparently “open to the possibility” of unexpected hazards, as Paget would applaud. Given Singer’s predilection for insulting the United States, it is not surprising that he did not mention this example of a U.S. scientist exercising caution that spared children in this country the disaster that befell over 9000 children elsewhere in the world.

Singer next mentions three other drugs that “were considered safe after animal tests but later proved

harmful” (Opren, practolol, and zipeprol). They supposedly provide further proof of the inadequacy of drug-safety testing in animals. In fact, Opren, a non-steroidal anti-inflammatory drug for treating arthritis, was known from early clinical trials to pose risks for people whose kidney function was compromised. Impaired renal function is a common problem in the elderly, who were the major target group for this drug (46). As has been pointed out by Willis (47), the Opren disaster was a result of overzealous marketing, not a failure of animal testing. Practolol, an adrenergic β -receptor blocker, produced some serious side effects in a very few patients. Because of the rareness of these occurrences, neither animal testing nor limited clinical trials could be expected to disclose this toxicity (48). The reference Singer gives for the nonopioid antitussive zipeprol (49) (for which he thanks British antivivisectionist Robert Sharpe) is a report on three cases of accidental overdose in children and 11 cases “in which the history pointed to habitual use of zipeprol for purposes of euphoria.” In other words, the drug has proven unsafe when taken at much higher than recommended doses, not when it was used as intended by the manufacturer. This should certainly not be regarded as a failure of animal testing, as implied by Singer.

In any case, the fact that Singer and the other AVs can cite only a few examples of drugs that have been recalled proves the opposite of what they intend. Two studies on the failure/recall rates of drugs that were released for human use in the United States and the United Kingdom over two different, though overlapping, time periods (50, 51) show that less than 3% of the new drugs introduced into the market have had to be recalled for safety reasons after their release. This figure is reassuringly low, and points to the efficacy of our present (post thalidomide) drug-testing regulations.

Singer continues:

As well as exposing people to harm, testing on animals may lead us to miss out on valuable products that are dangerous to animals but not to human beings. Insulin can produce deformities in infant rabbits and mice, but not in humans [Singer’s reference number 60]. Morphine, which is calming to human beings, causes mice to go into drug frenzies [Singer gives no reference]. And as another toxicologist has said: “If penicillin had been judged by its toxicity on guinea pigs, it might never have been used on man [Singer’s reference number 61].” (4, p57)

The reference for insulin is to the first page of Delahunt’s chapter in *Methods in Toxicology* (41, p132) which Singer again incorrectly ascribes to Paget. Delahunt used insulin as an example of a compound

which, when given in huge doses to pregnant mice or rabbits, can cause deformities in fetuses (not “infants”). As Delahunt notes, “most pharmacologically active agents, tested under certain circumstances, can be shown to be teratogenic in experimental animals.” The rest of the chapter addresses how toxicologists can, nevertheless, perform tests to provide meaningful predictive information about the teratogenicity of prospective human therapeutic agents. Therapeutic doses of insulin have not been shown to be teratogenic in any animal.

The statement about penicillin toxicity in guinea pigs—a favorite of the antivivisectionists—is based on a comment made by G. F. Somers (who was the first investigator to show that thalidomide is teratogenic in rabbits [44]) during a discussion at a conference held in 1958 (52, p195). This statement shows that toxicologists are not infallible (a judgement compounded by Somers’ next sentence, in which he extolled the virtues of diethylstilbestrol!). The facts about the alleged toxicity of penicillin in guinea pigs have been clarified by Botting in a review (53). Briefly, most of the early testing of penicillin was done in mice and rabbits, in which the antibiotic is well tolerated. The subsequent finding that penicillin is toxic to guinea pigs received much attention because of the drug’s virtual lack of toxicity in other animals. Contrary to what is often claimed by animalists, however, penicillin is not *highly* toxic to guinea pigs. In fact, the first report of toxicity involved giving the animals high doses of a very impure preparation of the drug (54). The authors of that article state clearly that when guinea pigs were given doses of the antibiotic in the same range as those used therapeutically in humans, the animals tolerated penicillin quite well. Subsequent studies showed that penicillin exerts its toxic effects in guinea pigs by killing the gram-positive bacteria in the animals’ intestines. These microbes normally suppress the growth of harmful bacteria; when the “good” ones are eliminated, pathogenic bacteria flourish and produce toxins, killing the animals (55). The same phenomenon leads to superinfection after penicillin therapy in some humans (56).

Next, Singer states:

After decades of mindless animal testing, there are now some signs of second thoughts. As Dr. Elizabeth Whelan, a scientist and executive director of the American Council on Science and Health, has pointed out: “It doesn’t take a Ph.D. in the sciences to grasp the fact that rodent exposure to the saccharin equivalent of 1,800 bottles of soda pop a day doesn’t relate well to our daily ingestion of a few glasses of the stuff.” Whelan has welcomed the fact that officials at the Environ-

mental Protection Agency recently downgraded earlier estimates of risks of pesticides and other environmental chemicals, noting that the evaluation of cancer risk, derived from animal extrapolation, was based on “simplistic assumptions” that “strain credibility.” This means, she says, that “our regulators are beginning to take note of the scientific literature rejecting the infallibility of the laboratory animal test.” (4, pp57–58)

The source of this quotation, according to Singer, is a “[s]yndicated article appearing in *West County Times* (California), January 17, 1988” (4, Note number 62, p276). This is a local newspaper with a limited distribution. By coincidence, the *West County Times* is published in our area of residence and copies are kept on microfilm in a local library. Thus, we thought it would be an easy matter for us (but not for someone living outside our area) to check this reference. However, there was no article by Dr. Whelan in the cited issue of that newspaper, nor in others around that date. Accordingly, we wrote to her to inquire whether she knew what the source of that quotation might be. In her letter of reply, she stated:

Peter Singer’s “quotes” are totally out of context and completely misrepresent the position of me as an individual and the American Council on Science and Health as an organization.

The quotes he uses—taken from a media report of one of my many speeches—were from my statements relative to the limitations of animal cancer testing for extrapolation to predict human cancer risk. I have long argued that a mouse is not a little man and to assume that just because some huge chemical exposure increases the risk of cancer in mice is no reason to assume that trace exposures of that same chemical pose a human cancer risk. Our position is spelled out in the enclosed booklet “Mice and Men” [57].

ACSH has a long history of noting that animal research is critical in biomedical research, including cancer research. In no way do we support any effort to stop animal testing.²

Subsequently we found a syndicated column by Dr. Whelan in the *Los Angeles Times* (“Praise EPA for Easing Off on Carcinogenic Trivial Pursuit,” January 18, 1988, Part II, p7) that contained the phrases quoted by Singer. The article is not a blanket criticism

² Whelan EM. Personal communication to CS Nicoll, December 17, 1991.

of animal use in toxicity testing, as Singer suggests, but rather an elaboration of the remarks Dr. Whelan made in her letter about the danger of extrapolating from data acquired from carcinogenicity studies using megadoses of chemicals in very sensitive animals to assess human risk from microdose exposure. This example is illustrative of the "scholarship" of Peter Singer in two ways. First, the citation he gave was incorrect, and it was to a newspaper that would be impossible for most readers to find. Second, as Dr. Whelan's letter pointed out, it was misleading as to the meaning of her remarks and the position of her organization (the ACSH) on the issue of using animals for testing purposes. The ACSH has recommended ways in which carcinogenicity testing on animals might be improved to provide more reliable and useful information (57).

On page 58, Singer continues on in the same vein. He states:

The American Medical Association has also admitted that animal models have questionable accuracy. An AMA representative testified at a congressional hearing on drug testing that "frequently animal studies prove little or nothing and are very difficult to correlate to humans." (4, p58)

The reference to which that quote was ascribed (58, pp58, 60) is an article in a veterinary medical trade journal which we had difficulty finding because the volume number cited by Singer was incorrect (4, Note number 63, p276). The article did contain the quoted statement, but the author, Melinda Benson, did not name the AMA representative who supposedly so testified, nor did she give a reference to, or other information about, the alleged congressional hearing. We were unsuccessful in reaching Ms. Benson, as she no longer works for the magazine. We wrote to the AMA to learn whether they had any knowledge of such a statement. An executive in that organization informed us that they had no record of any of their representatives making such a statement.³ The AMA is on record as being completely supportive of humanely conducted animal research and product-safety testing (59), and has repudiated such statements as that ascribed by Benson and by Singer to one of its representatives. Responsible scholarship requires that the accuracy and authenticity of quotes be verified with care, particularly when they appear to be at odds with the well-known positions of groups and their spokespeople. Singer apparently did not do this verification.

Singer spends the next pages describing how ani-

mal activists have been successful in "persuading" scientists to find substitutes for animals in toxicity testing, including replacements for the LD₅₀ test, which he had discussed at length just a few pages earlier, implying that it is still widely used (4, pp53-54).

"Medical Research"—For Curiosity and Greed?

On page 61 Singer states:

When experiments can be brought under the heading "medical" we are inclined to think that any suffering they involve must be justifiable because the research is contributing to the alleviation of suffering. But we have already seen that the testing of therapeutic drugs is less likely to be motivated by the desire for maximum good to all than by the desire for maximum profit. The broad label "medical research" can also be used to cover research that is motivated by a general intellectual curiosity. Such curiosity may be acceptable when it involves no suffering, but should not be tolerated if it causes pain. (4, p61)

Singer thus seemingly places "general intellectual curiosity" on the same ethical plane as "desire for maximum profit" (i.e., greed). This statement shows not only his disdain for the acquisition of knowledge, but also how he fails to take into account the process by which discoveries that lead to the alleviation of suffering are made. He appears not to recognize the importance of basic research for medical progress. A succinct—and poignant—example of the necessity and motivation for doing basic research is found on a wall plaque at a cancer research center that was made famous by Erma Bombeck in her book, *I Want to Grow Hair, I Want to Grow Up, I Want to Go to Boise: Children Surviving Cancer*:

This disease of cancer will be banished from life by calm, unhurrying, persistent men and women working in hospitals and laboratories and the motive that will conquer cancer will not be pity nor horror. It will be the curiosity to know how and why. (60, p134)

Over the next two pages Singer delivers a litany against 10 papers, beginning with a report from 1880, on heatstroke in animals. It is our opinion that he chose these papers for discussion because their descriptions of convulsions, etc., were very dramatic. He trivializes the intent of the experiments as well as their findings in typical fashion, saying that "the major finding seems to be the advice that heatstroke victims should be cooled—something that seems to be fairly elementary common sense" (4, p64). Singer criticizes in particular the use of dogs as a model for human heatstroke, saying, "B. W. Zweifach showed in 1961

³ Loeb JM. Personal communication to CS Nicoll, May 22, 1992.

that dogs are physiologically different from human beings in ways that affect their response to heatstroke, and hence they are a poor model for heatstroke in human beings" (4, p64). This statement is of interest because Zweifach's paper (61), for which Singer uncharacteristically provides a title, deals with *physiological shock*, such as that which occurs following hemorrhage or a severe allergic response, and not with heatstroke. Heatstroke is not even mentioned in the paper. (This paper was also somewhat difficult to find because Singer's citation includes a journal—"Federal Proceedings [sic]"—which does not exist [4, Note number 87, p278]. The paper was published in the *Federation Proceedings*). Zweifach does point out that the differences in physiology among species complicate the study of such complex phenomena as shock, and notes that "there is a need for a systematic study on a comparative basis of the cellular components involved" so that comparisons of responses to shock can be more meaningful (61, p26). Knowledge of these "cellular components" has increased dramatically in recent years, thanks to continued animal research (62).

It is interesting that Singer fails to mention the discussion following Zweifach's paper, which was presented at a conference on shock. Discussant C. Ladd Prosser might have been answering Singer's criticism about animal models when he stated:

Dr. Zweifach has called attention to a number of anatomical, physiological and immunological differences between the common laboratory species. I agree that these species differences make direct transfer of information obtained by study of laboratory animals to man difficult. . . . The important value of animal physiology is not its immediate application to medicine, but rather the understanding of the nature of life processes. That these processes occur in great diversity, that different kinds of animals "solve" a given physiological problem in different ways is not disturbing, but is rather satisfying to the comparative physiologist. . . . Of course, one hopes that with better understanding of fundamental physiological principles based on animal experiments, the medical physiologist may be able to ask more pertinent questions in his study of man. (61, p27)

Singer next regales the reader with categories of experiments "reported in the journals" such as "Blinding," "Burning," "Centrifuge," "Compression," and many more equally useful and explanatory terms, then reiterates what is becoming almost a mantra in his chapter:

While some of the experiments may have led

to advances in medical knowledge, the value of this knowledge [as judged by Singer] is often questionable, and in some cases the knowledge might have been gained in other ways. Many of the experiments appear to be trivial or misconceived, and *some of them were not even designed to yield important benefits.* (4, p65, emphasis added)

At this point Singer inexplicably begins talking about experimental physiological shock, the topic of the Zweifach paper he had incorrectly cited (61). Singer describes decades-old papers, using the "chamber of horrors" language of which he is so fond, and he dwells on a "controversy" in the scientific literature in the 1940s and 1950s over whether anesthetics should be used during studies on shock, in such a way that it would appear the controversy continues today. He does not inform the reader that, as of at least 1961, investigators agreed that "animal studies of shock must be done under anesthetic," as Prosser pointed out (61, p28). Neither does Singer mention that, as our knowledge of the pathophysiologic mechanisms underlying circulatory shock has increased, so has our ability to treat what used to be known as "irreversible shock." (Comparing Zweifach's 1961 review [61] with a modern discussion of circulatory shock, e.g. Ref. 62, pp576-581, is instructive.) Obviously, the animal research Singer criticizes so passionately had helped to provide that knowledge.

On page 66 of his chapter, Singer begins a denunciation of the use of animals for studies on drug addiction. He quotes from a paper of Gerald Deneau about the self-administration of cocaine in rhesus monkeys, in which the investigator reported:

the monkeys pushed the button over and over, even after convulsions. They went without sleep. They ate five to six times their normal amount, yet became emaciated. . . . In the end, they began to mutilate themselves and, eventually, died of cocaine abuse. (quoted in 4, p66).

Singer continues: "Dr. Deneau has acknowledged that 'few people could afford the massive doses of cocaine these monkeys were able to obtain.' "

We were unable to confirm the authenticity of these quotes because Singer's reference, "*Health Care* 2(26), August 28-September 10, 1980" (4, Note number 92, p279), could not be located. In any case, what Singer presents as a *prima facie* case of animal abuse might seem to be a good reason to carry out animal experiments on drug addiction to someone who is concerned about the human tragedy associated with the enormous problem of drug abuse in this country and elsewhere. The power of drugs over the emo-

tional/motivation center of the brain—the evolutionarily ancient limbic system—is frightening. But this power means that the physiology of addiction can be studied in animals, with reasonable hope of then applying the information in a meaningful way to humans. Research on the chemical mediators of motivation and behavior has already provided insights into a broad range of normal and abnormal mental states (63).

After describing in disparaging terms two other drug studies using dogs and rats, Singer relates “an even more bizarre example of drug research” (4, p67): the administration of LSD to elephants. We admit that “bizarre” might *appear* to be an appropriate description for such research, but probably not to someone who had read the paper (64). Male elephants periodically exhibit a wildly aggressive behavior apparently related to reproduction and territoriality called “musth.” In an animal as large as an elephant, violent, aggressive behavior is dangerous to humans and other animals, including other elephants. The author of the paper cited by Singer (64), Ronald Siegel, described a study done in 1962 (65), in which investigators injected LSD into a male elephant to attempt to “induce experimentally a behavior syndrome resembling musth” (64, p53). The results were inconclusive because, after a short period of increased aggression, the animal collapsed and died. According to Siegel, this study had continued to receive attention and provoke controversy, and so he repeated it, using one male and one female elephant. In his hands, the animals survived two doses of LSD, and although the male did briefly show increased aggression (contrary to an assertion by Singer [4, p68], Siegel did not refer to this aggressive behavior as “inappropriate”; that adjective was used to describe the ataxia which followed the aggression), Siegel concluded that LSD, which blocks release of the neurotransmitter serotonin, did not induce a satisfactory model of musth behavior. This conclusion was disappointing, because understanding the neurochemical mechanisms underlying musth and finding ways to modify the resulting behaviors would clearly be beneficial to wild and captive elephants, which may otherwise be destroyed because of the danger they pose to humans and to themselves. This is yet another example of Singer’s method: to inflame, not explain.

Singer next relates, with relish, the story of Michiko Okamoto, who terminated her peer- and funding agency-praised barbiturate research on cats in 1988 because of pressure applied on her and her research institution by animal rights groups (66). Singer quotes from a paper written by Okamoto in 1976, in the early phases of her research, in which large doses of barbiturates were given to cats and then withdrawn, producing convulsions and other severe withdrawal symptoms (4, p68). He fails to mention that Okamoto’s later studies used small doses that produced less dis-

tressing symptoms, nor does he point out that her work, which was characterized by a colleague as “impeccable” and “a shining, crystal example of how to do science” (66, p1002) has provided important information about the physiology of drug dependence and tolerance. At this point Singer tells us that barbiturate abuse is no longer a problem (an opinion that is not shared by the National Institute on Drug Abuse [66]). The Okamoto case is a chilling example of what can happen when animal rights groups target a specific research project or researcher, especially when the researcher’s institution is not prepared for the attack. According to Singer, this case had “a happy ending.” To the extent that it alerted the biomedical community to the dangers to scientific inquiry posed by the animal “protection” movement, he may be partially correct.

Beware of Monsters in White Coats. “How can these things happen?” asks Singer (4, p69). He goes on:

How can people who are not sadists spend their working days driving monkeys into lifelong depression, heating dogs to death, or turning cats into drug addicts? . . . How did students carry on protests against injustice, discrimination, and oppression of all kinds, no matter how far from home, while ignoring the cruelties that were—and still are—being carried out on their own campuses?

The answer to these questions lies in the unquestioned acceptance of speciesism. . . . Speciesism allows researchers to regard the animals they experiment on as items of equipment, laboratory tools rather than living, suffering creatures. . . .

[S]ome special factors also help to make possible the experiments I have described. Foremost among these is the immense respect that people still have for scientists. Although the advent of nuclear weapons and environmental pollution has made us realize that science and technology are not as beneficial as they might appear at first glance, most people still tend to be in awe of anyone who wears a white coat. (4, p69)

The first paragraph of the above quote is essentially a call to arms to the idealistic protestors on college campuses. The second appeals to their “liberalism,” saying, in essence, “speciesism” is a bad thing, like racism or sexism, and must be protested. The third is a thinly veiled appeal to feelings of distrust of science, and an attempt to “defrock” scientists of their cloak of respect. Distrust of science is a prevalent attitude among antivivisectionists. Jamison and Lunch (67) surveyed animal activists participating in the “March for the Animals” in Washington, DC (June 10,

1990), and found that a majority of them believed that science has done more harm than good. By contrast, only 5% of the general public harbor such anti-science sentiment (67).

Interestingly, the only scientist of whom we are aware who has made a statement about regarding research animals as "items of equipment" is Donald Barnes (quoted in Ref. 68, p60), a former researcher who is now employed by the National Anti-Vivisection Society. Singer quotes Barnes as claiming to have recovered from "conditioned ethical blindness" (4, p71). According to Singer (4, p70), another example of a scientist who claims to have belatedly "seen the ethical light" is former psychology researcher Roger Ulrich. Ulrich's contribution to this debate has been previously critiqued by Miller (69), and we have previously analyzed Barnes' contributions (9).

Next, Singer attempts to undermine public trust and faith in veterinarians. He notes, with regret, "No doubt many veterinarians did go into the field because they cared about animals, but it is difficult for people who really care about animals to go through a course of study in veterinary medicine without having their sensitivity to animal suffering blunted" (4, p71). He then quotes from a former would-be veterinary student who "painfully decided to pursue a different career" after having "numerous confrontations with . . . heartless vivisectionists" in his/her undergraduate pre-veterinary medicine courses (4, pp71-2). It is difficult for us to see how learning to help animals through veterinary medicine should blunt one's sensitivity to their suffering, nor can we feel much pity for someone who had to make a change in career plans when he/she found that veterinarians require hands-on learning about physiology, or that veterinary practice might involve such unpleasant, though life-saving, procedures as surgery.

Then Singer springs his trump card with regard to veterinarians when he states:

The basic attitude of the profession was, as an article in the Journal of the American Veterinary Medical Association put it, that "the *raison d'être* of the veterinary profession is the overall well-being of man—not lower animals." Once the implications of this fine example of speciesism have been grasped, it should surprise no one to learn that veterinarians were part of the experimental teams that performed many of the experiments listed in this chapter. . . .

Throughout America, veterinarians are standing by providing "routine care" for animals who are being needlessly abused. (4, p72)

Thus, Singer makes the fact that all American re-

search facilities have trained veterinary staff to oversee the health and well-being of research animals seem to be a conspiracy to commit animal abuse, rather than a reassurance that trained professionals are doing their best to promote the welfare of research animals, as is the case.

Then Singer "explains" this situation by saying, in essence, that animal research continues to be done solely because scientists, institutions, and funding agencies are all entrenched in the practice. "New methods that do not make use of animals will seem less familiar and will be less likely to receive support" (4, p72). This statement is as incredible as it is untrue, coming as it does in a book published at the end of the 1980s, "Decade of Molecular Biology," during which the vast majority of biomedical researchers were studying phenomena at the level of the cell, using cell cultures and often "immortal" cell lines. Table II shows that during 1990-1991, the vast majority (77.5%) of the biomedical research faculty at five major research campuses in Northern California used these so-called alternatives exclusively or almost exclusively. Less than 10% used significant numbers of animals (i.e., >1000 per year) during that period.

Next Singer states, inexplicably, "All this helps to explain why it is not always easy for people outside the universities to understand the rationale for the research carried out under university auspices" (4, pp72-73). This sentence does not seem to follow logically from what preceded it—and in fact, as we have seen, Singer avoids discussing "rationale" throughout his chapter. Certainly, readers of his book would not find it easy to understand such rationale unless they did the unthinkable—read the actual papers. Singer continues:

Originally, perhaps, scholars and researchers just set out to solve the most important problems and did not let themselves be influenced

Table II. Use of Animals and Alternatives to Animals by Biomedical Research Faculty at the University of California at Berkeley, Davis, San Francisco, and Santa Cruz, and at Stanford University

	No.	Percentage
Investigators using alternatives and:		
No animals	1315	55.5
Few animals (<120/yr)	521	22.0
A moderate number of animals (120-1000/yr)	330	13.9
A large number of animals (>1000/yr)	203	8.6
Total	2369	100.0

Note. Based on data collected by the U.S. Department of Agriculture for 1990 or 1991.

by other considerations. No doubt some are still motivated by these concerns. Too often, though, academic research gets bogged down in petty and insignificant details because the big questions have been studied already and they have either been solved or proven too difficult. So the researchers turn away from the well-plowed fields in search of new territory where whatever they find will be new, although the connection with a major problem may be remote. It is not uncommon, as we have seen, for experimenters to admit that similar experiments have been done many times before, but without this or that minor variation; and the most common ending to a scientific publication is "further research is necessary." (4, p73)

Perhaps we should be grateful for Singer's acknowledgment that some "big problems" have been solved. We wonder, though, who it is that has passed judgment on some problems as being "too difficult" for further study. We can think of no question—even in the most complex areas of biomedicine, such as brain physiology or the workings of the immune system—where researchers are "turning away" or getting "bogged down in petty details." Furthermore, Singer contradicts himself, saying that researchers are exploring new territory and at the same time are "entrenched" and guilty of endless repetition.

In the next paragraph, Singer reverts to an old theme, with a variation intended to stun the reader:

When we read reports of experiments that cause pain and are apparently not even intended to produce results of real significance [we wonder what could possibly qualify as being "really significant" to Singer], we are at first inclined to think that there must be more to what is being done than we can understand—that the scientists must have some better reason for what they are doing than their reports indicate. [In actuality, the reason for what a scientist is doing is usually clear enough from the reports, but not, of course, from Singer's rendition of them.] . . . When we go more deeply into the subject, however, what appears trivial on the surface really is trivial. Experimenters themselves often unofficially admit this. H. F. Harlow . . . was for twelve years the editor of the *Journal of Comparative and Physiological Psychology*. . . . At the end of this period, in which Harlow estimated he reviewed 2,500 manuscripts for publication, he wrote, in a semihumorous farewell note, that "most experiments are not worth doing and the data attained [should read

"obtained"] are not worth publishing." (4, p73)

This is a mischaracterization of a paper Harlow wrote as a spoof on the travails of being a journal editor and dealing with would-be authors (70). In it, he "semihumorously" advises prospective authors among other things to bribe the editor of the journal in his/her covering letter, and warns against writing "succinctly and clearly" because "there is a real danger that the reader will only read your manuscript once," and so on. We cannot believe that anyone could be so devoid of a sense of humor that they would not recognize this farce for what it is. On the other hand, admitting that Harlow's statement was completely in jest would not have served Singer's purpose of discrediting science.

Singer ends this section with the unnecessary admonition that "researchers, *even those in psychology, medicine and the biological sciences*, are human beings" (4, p73, emphasis added). He goes on to say that as such, they publish papers to advance their careers. This happens in other fields as well, Singer admits, but

[t]he philosophers and historians who publish to improve their career prospects do little harm beyond wasting paper and boring their colleagues; those whose work involves experimenting on animals, however, can cause severe pain or prolonged suffering. Their work should therefore be subject to much stricter standards of necessity. (4, p74)

Singer appears to have broadened his anti-intellectual brush to cover even those in his own field. While we are tempted to agree that Singer's *Animal Liberation* may be a waste of paper, we would rather think that the majority of historians and philosophers—like the majority of scientists—who publish do so because they have something to say. "Severe pain" and "prolonged suffering" actually rarely occur in animal research (Table III) (71).

Scientists as Ignoramuses. Singer begins his

Table III. Percentage of Animal Research Procedures That Involve Pain or Discomfort to the Animal Subjects at Three California Universities

Type of procedure	Percentage
No exposure to pain or discomfort	44.1
Pain/discomfort relieved by anesthetics and/or analgesics according to recommended veterinary practices	51.8
Pain-relieving drugs omitted because they would interfere with results	4.1

Note. From U.S. Department of Agriculture survey of animal use at University of California campuses at Berkeley, Davis, and San Francisco for 1988–1990. Includes data on rodents and other mammals.

next section reminding the reader that several government agencies in the United States fund research projects. He goes on:

Since these experiments are paid for by government agencies, it is hardly necessary to add that there is no law that prevents the scientist from carrying them out. There are laws that prevent ordinary people from beating their dogs to death, but in the United States scientists can do the same thing with impunity, and with no one to check whether their doing so is likely to lead to benefits that would not occur from an ordinary beating. The reason for this is that the strength and prestige of the scientific establishment . . . have been sufficient to stop attempts at effective legal control. (4, pp74-75)

The allegations that scientific research is akin to dog beating and that it is unregulated are false. Singer expounds at length on the alleged lack of legal control over the use of animals in research in the United States later in his chapter. But now he wishes to introduce the reader to two distinguished researchers, neurosurgeon Robert J. White and Nobel laureate biochemist David Baltimore, in much the same manner as he earlier introduced Harry Harlow. Of White, Singer says he “specialized in transplanting the heads of monkeys and keeping these heads alive in fluid after they have been totally detached from their bodies.” White pioneered research on brain transplantation in order to observe directly the effects of changes in temperature, loss of circulation, and so forth, on the brain—knowledge that has direct bearing on human health, and which White himself has used to save human lives (72). Singer quotes from a report in a South African magazine (*Scope*, Durban, South Africa, March 30, 1973) to which few people have access. The reporter allegedly found “the visit to White’s laboratory ‘a rare and chilling glimpse into the cold, clinical world of the scientist, where the life of an animal has no meaning beyond the immediate purpose of experimentation’ ” (4, p75). This picture is quite different from the one painted by an article in the Cleveland *Plain Dealer*, from which Singer quotes selectively. A section of the article *not* mentioned by Singer quotes some people who have dealt with White:

“Wonderful man,” says Sam Miller. . . .
“He could have gone into private practice and made an untold fortune. He traded wealth for goodness.”

“He’s fantastic,” says John Waterston, a patient recovering from surgery. . . .

Despite all this human affection, White says there is room in his heart for animals. He

has four cats and had several dogs as a child. (72, p1-B)

Singer also ignores the threats made to White, his wife, and their children by animal activists, which were reported in the same article. Singer uses this article only to point out that White “chafes at regulations, whether from hospital administrators or insurers. ‘I’m an elitest,’ he says. He believes doctors should be governed by their peers” (72, p6-B, quoted in 4, p75).

Then Singer writes:

Another active opponent of government regulations is David Baltimore. . . . In a recent address to the American Association for the Advancement of Science he referred to the “long hours” that he and his colleagues had spent fighting *regulation* of their research. (4, p75, emphasis added)

The basis for this statement is an article in *The Birmingham News*, which begins:

Ignorance and fear continue to threaten the progress of modern biology, Nobel laureate David Baltimore said Thursday.

“Many of us have had to spend long hours fighting for the right to continue doing research.” . . .

Part of his criticism fell on animal-rights advocates opposed to using animals in research and those who have tried to block genetic engineering experiments. . . .

and ends:

Researchers carry the responsibility to explain their work to the public, Baltimore said. If that is combined with better scientific education, the public will find it easier to trust scientific progress, he said. If that doesn’t happen, “. . . the weight of ignorance will drag us back,” he said. (73)

Nowhere in the article is any mention made of “regulations,” much less fighting them, as Singer states. The fight to which Baltimore referred is the battle against the ignorance (and the ignorant) that he warned against in his address. Our present critique is a part of that fight. Nevertheless, Singer goes on to describe for us what he considers “the basis for Baltimore’s [undocumented] opposition to such regulation”—a 1974 television program for which transcripts are no longer available, in which Baltimore supposedly “interjected” (in a paraphrase by Singer) that “he did not think that experimenting on animals raised a moral issue at all” (4, p75).

Singer had earlier quoted from an essay by White (74):

In White's view, "the inclusion of animals in our ethical system is philosophically meaningless and operationally impossible." In other words, White sees himself as under no ethical constraints in regard to what he does to animals. (4, p75)

Singer sums up: "Men like White and Baltimore may be brilliant scientists, but their utterances on animals show that they are philosophical ignoramuses" (4, pp75-76).

First, we do not know what Baltimore actually said in the television program, since we have only Singer's paraphrasings. Second, Singer twists White's words to give them his own meaning. The fact that White sees animals, which cannot know right from wrong and are thus *amoral* creatures, as not being able to participate in our system of ethics in no way implies that he believes himself to be free of ethical constraints as to his treatment of them. As is clear from his writings (e.g., Ref. 74), White, like most people, agrees that our moral codes require us to promote animal welfare and to provide humane treatment for the animals we use. Animals are outside of our moral sphere because they know nothing of morality. Thus, it seems to us that White is on sounder philosophical footing than is Singer.

The Intransigence of American Scientists. Singer goes back now to the subject of regulating animal research, and spends the next four and one-half pages (4, pp76-80) describing, in what we regard as a misleading manner, the regulations that apply to animal research in the United States. From his account, it would seem that researchers in the United States are free to do "exactly as they please" with animals with no oversight whatsoever (4, p76). Singer quotes occasionally from and cites repeatedly the chapter entitled "Federal Regulation of Animal Use" from the 1986 Office of Technology Assessment (OTA) report (13), but in typical fashion picks and chooses from the chapter, ignoring sentences and paragraphs that refute his thesis. For example, he states:

One section of the [Animal Welfare Act; AWA] requires that those private businesses and other organizations that register under the act (neither government agencies doing research nor many smaller facilities have to register) must file a report stating that when painful experiments were performed without the use of pain-relieving drugs, this was necessary to achieve the objectives of the research project. No attempt is made to assess whether these "objectives" are sufficiently important to justify inflicting pain. (4, p76)

Here Singer begins by implying that major research

institutions do not even have to register under the act, whereas the OTA report states that "research facilities" must register, and defines them as

any individual, institution, organization, or postsecondary school that uses or intends to use live animals in research, tests, or experiments and that purchases or transports live animals in commerce or receives Federal funds for research, tests, or experiments. (13, p281)

This definition applies to the vast majority of institutions that do research with animals. With regard to government agencies:

Federal agencies with laboratory-animal facilities are required to comply with regulations for humane treatment in commerce as they apply to nongovernmental research facilities. (13, p283)

Furthermore, every research facility is required to

show annually that professionally acceptable standards governing animal care, treatment and use, "including appropriate use of anesthetic, analgesic, and tranquilizing drugs, during experimentation are being followed by the research facility during actual research or experimentation." (13, p282; The quote is from Title 7 of the U.S. Code Annotated, section 2143a.)

The overseer of the humane treatment of research animals is the "institutional animal committee," or animal care and use committee, the composition of which varies with the institution but has a minimum of three members, of whom one must be a veterinarian and another a person who is not affiliated with the research facility, "to provide representation for general community interests in the proper care and treatment of animals" (13, p281). In practice, the committees are usually considerably larger. These committees must approve research protocols and inspect research areas at least twice a year. They keep records about the number of experiments performed with respect to three categories: (i) those involving no pain or distress; (ii) those in which the use of appropriate anesthetics, etc., prevented pain or distress and; (iii) those in which anesthetics, etc., were withheld because they would adversely affect the outcome of the experiment. Only 4%-6% of experiments fall into the third category (Table III) (71), and they, like those in the other categories of experiments, must be justified by the investigator and approved in advance by the committee (13, pp284, 340-341). A second level of control is at the granting agencies, which must approve experiments before they are funded. Singer's assertion that no attempt is

made to assess whether the objectives of an experiment are important enough to justify inflicting pain is simply not true.

Singer goes on to extol the relative virtues of other countries with regard to their regulations for animal research. "American standards in this matter are abysmal, not just by the standards of animal liberationists, but by those accepted by the scientific communities of other major developed nations," he opines (4, p78). He cites as examples Australia and Sweden, which have research oversight committees that contain lay members (but he ignores the fact that the United States does, as well). He claims to have been "taken aside" by scientists at "medical and scientific conferences" he supposedly attends in Europe and Australia, "and they tell me, with genuine horror in their voice, about something they saw during their last trip to the United States." He goes on: "As the United States lagged behind the civilized world in outlawing human slavery, so the United States lags behind in softening the unrestrained brutalities of animal slavery" (4, p79).

Then Singer labels the regulation of animal experimentation in the United States "a continuing farce" because the AWA does not cover rats and mice. While this is technically true, and it is also true that the vast majority of research animals used in the United States are rodents, these animals are nevertheless covered by the Public Health Service (PHS) Act, which was amended in 1985 to provide "statutory authority for and recognition of certain elements of the PHS *Policy on Humane Care and Use of Laboratory Animals by Awardee Institutions*" (13, p291). Any institution that receives funding for animal research from the PHS must have an institutional animal care and use committee that oversees all animal research, including research with rats and mice. The only difference is that the U.S. Department of Agriculture does not necessarily have to inspect the rodent facilities, allowing its inspectors to spend more time in facilities housing cats, dogs, primates, etc. To extend the AWA to rats and mice would increase the cost (in terms of both time and money) of regulating animal research without necessarily improving animal care (13, pp293–294). The chairman of the Board of Directors of the American Council on Science and Health commented on this issue in a recent syndicated newspaper column:

While America spends \$25 billion a year on biomedical research, and tens of millions to rid our city streets and alleys of rats, it seems almost obscene to be talking about what may be another billion dollar bureaucratic nightmare to protect rats' rights.

Animal compassion is one thing. Costly

foolishness in the name of animal compassion is quite another. (75)

Animal Liberation, Human Experimentation, and the Nazis. At this point, Singer prepares the reader for even more horrific tales, based on his having "established" that the United States is essentially lawless in terms of animal research:

In descriptions of experiments in this chapter up to now, I have limited myself to summarizing the reports written by the experimenters themselves and published in the scientific journals. That evidence cannot be accused of being exaggerated. *But because of the total lack of any adequate inspection or scrutiny of what happens in experiments, the reality is often much worse than the published account.* (4, p80, emphasis added)

Here Singer describes some of the "evidence" obtained from laboratory break-ins by the Animal Liberation Front (ALF), beginning with their theft of videotapes in 1984 from the University of Pennsylvania laboratory of Thomas Gennarelli. Gennarelli's laboratory was engaged in head injury research using monkeys and baboons. Singer tells us that the "aim of the experiments was to inflict head injuries on monkeys, and then examine the nature of the damage to the brain." He goes on to say that the ALF stole videotapes of the experiments which showed "conscious, unanesthetized baboons struggling as they were strapped down before the head injuries were inflicted" and "experimenters mocking and laughing at frightened, suffering animals." Finally, after "more than a year of hard work by . . . People for the Ethical Treatment of Animals [PeTA] and hundreds of animal activists the secretary of health and human services stopped Gennarelli's funding" (4, p81).

Many readers of this article are probably familiar with the videotape that was widely distributed by PeTA as "Unnecessary Fuss." It consists of approximately 25 minutes out of 60 hours of stolen tape, with PeTA's national director Ingrid Newkirk "describing" what is being viewed on the film—or at least, the PeTA version of what is viewed. That a group of animal research abolitionists could string together 25 minutes of seemingly damning tape out of 60 hours of films of head injury research should not surprise anyone, and Singer is characteristically uncritical of the theft and subsequent use of the cut-and-pasted, out-of-context film. He also repeats the misleading allegation that the baboons were unanesthetized and conscious prior to injury, when in fact they were heavily sedated and probably insensible. There is also no evidence that any of the animals shown on the film were suffering or

frightened when the experimenters were permitting themselves some unfortunate “gallows humor.”

The worst aspect of the break-in, theft, and subsequent PeTA media circus was that some of Gennarelli’s animal research was indeed halted for some years because of the massive bad publicity and misrepresentation of the research, despite the university’s best efforts to publicize the true story. Head injury research is not pleasant to do or to contemplate, but there is a vital need for it. Currently, more than 500,000 cases of head injury occur each year in the United States and they account for about 70,000 deaths. The cost of treating the victims and rehabilitating the survivors is estimated to exceed \$25 billion annually. Fortunately, Gennarelli’s funding has been restored. His laboratory has already provided some extremely important information about how to treat victims of head injury (76). Among the findings from the animal laboratory that have had direct clinical applications is that the cerebral swelling that occurs after head trauma, and which causes secondary damage to brain tissue, is often a result of increased cerebral blood volume, not brain edema as had been previously thought. Treatments that counteract increased cerebral blood flow, such as hyperventilation, have been tested in the laboratory and are now used clinically. Various drugs are also being tested for their effects on brain hyperemia and ischemia. Other insights from the nonhuman primate work include correlations between the direction of head movement during brain injury and the severity of the coma following it, information which has important ramifications for the design of protective systems against head injury (76).

Singer goes on to give more examples of “undercover” work by laboratory invaders, and then digresses:

When are experiments on animals justifiable? Upon learning of the nature of many of the experiments carried out, some people react by saying all experiments on animals should be prohibited immediately. But if we make our demands as absolute as this, the experimenters have a ready reply: Would we be prepared to let thousands of humans die if they could be saved by a single experiment on a single animal?

This question is, of course, purely hypothetical. There has never been and never could be a single experiment that saved thousands of lives. The way to reply to this hypothetical question is to ask another: Would the experimenters be prepared to carry out their experiment on a human orphan under six

months old if that were the only way to save thousands of lives? (4, p81)

Singer goes on to say that, if the experimenters are reluctant to use the human infant, then they are guilty of “an unjustifiable form of discrimination on the basis of species.”

Thus, in three sentences Singer erects a straw man—the impossible “single experiment on a single animal,” which no scientist would use as a “reply” to people who wish to end all animal experimentation—and knocks it down himself, so that he can introduce the idea of using human infants instead. Singer could have answered his rhetorical question, “When are experiments on animals justifiable?” with an honest examination of the case he just finished describing from his perspective—the Gennarelli head injury experiments. Over the years, those experiments have used a considerable number of animals to generate knowledge that has already saved thousands of lives and will save many more. Are those experiments justified? But Singer does not ask this logical question, nor does he give the reader an honest portrayal of the costs or the benefits of that or any other research. Instead, he opts to explore the “human infant versus the adult animal” equation.

So far as we know, human infants possess no morally relevant characteristic to a higher degree than adult nonhuman animals, unless we are to count the infants’ potential as a characteristic that makes [their use in experimentation] wrong. Whether this characteristic should count is controversial—if we count it, we shall have to condemn abortion along with experiments on infants, since the potential of the infant and the fetus is the same. (4, p82)

Here Singer introduces, perhaps inadvertently, a troubling aspect about the animal liberationist philosophy for many of its adherents—the idea that, to be consistent, they should oppose abortion as well as animal experimentation. In fact, however, few of them do, in keeping with their generally “liberal” political bent (77). The abortion issue is one that they prefer not to think about. Singer steps around this problem by proposing the hypotheticals that the infants to be used for force-feeding “with large quantities of floor polish” or for having “concentrated solutions of cosmetics” dripped in their eyes, be victims of “irreversible brain damage,” and thus lack the potential to be a normal human (4, p82). Singer thus artfully switches his question from one experiment which will “save thousands of lives” to trivial-sounding product-safety testing, as he brings up the morally repugnant idea of experimenting on brain-damaged human infants. His message is,

if you can accept experiments on animals, then you must accept them on humans “at the same mental level” in order to avoid “speciesism”—“a bias no more defensible than racism or any other form of arbitrary discrimination” (4, p82).

Singer next makes the seemingly “logical” correlation between animal experimentation—an outcome of “speciesism”—and the horrors inflicted by Nazi doctors in the name of racism. This equation is odious—the dehumanization of human beings, denying them their humanity, is *not* the same thing as treating nonhuman animals as “not human”—and, on another level, ridiculous. First, the Nazis viewed their Jewish victims with fear and loathing, which are not the normal emotions expressed by animal experimenters toward their subjects. Second, much of the experimentation done on prisoners at Auschwitz and other camps was on methods of sterilization to aid in the Nazi plan of genocide, and the experiments were “no more than a small part of the extensive and systematic medicalized killing” (78, p269) by SS doctors. An irony that Singer overlooks is that the Nazis themselves were antivivisectionists from the standpoint of experimentation on animals (79, 80).

Singer describes one Nazi experiment in which a human being is placed in a decompression chamber, and then segues into how “decompression chamber experimentation . . . shifted to nonhuman animals [pigs] at the University of Newcastle on Tyne, in England” (4, p84). The pigs in this study “all suffered attacks of decompression sickness” according to Singer. This is notable because it is one of a very few instances in which Singer criticizes scientists outside of the United States, and only a few pages earlier he in effect exonerated the British system, suggesting that it does not allow experiments that cause suffering (4, pp77–78). Singer then returns to criticism of the United States by reminding the reader of the dreadful Tuskegee, Alabama, study of syphilis in black Americans over a period of decades. The subjects were not intentionally inflicted with the disease, and the study began before penicillin was discovered; the real horror was that penicillin was withheld from the study’s participants after it became available. Singer is correct in decrying this racist travesty—but we should keep in mind that Singer would also have decried the very animal experiments that led to the discovery of the antibiotic properties of penicillin in the first place. The proper response to the Tuskegee tragedy is to ensure that no human being is ever used in such a way again. Singer, of course, takes the message farther: “Since a speciesist bias, like a racial bias, is unjustifiable, an experiment cannot be justifiable unless the experiment is so important that the use of a brain-damaged human would also be justifiable” (4, p85). Again, Singer

equates humans with animals in a way that demeans humans.

Singer then resurrects his straw man, and again shows the level of his understanding of science: “If it were really possible to save several lives by an experiment that would take just one life [presumably the brain-damaged human one], and there were no other way those lives could be saved, it would be right to do the experiment” (4, p85). And so, the impossible experiment (and *only* the impossible experiment) gets Singer’s blessing. He adds the gratuitous: “Certainly none of the experiments described in this chapter could pass this test.”

Singer goes on to “rally the troops” with more hyperbole: “As this chapter has shown, we are in the midst of an emergency in which appalling suffering is being inflicted on millions of animals for purposes that on any impartial view are obviously inadequate to justify the suffering” (4, p85). He then spends more than a page again chastising the United States for its “lack of control over experimentation” (4, p86) and championing the use of “ethics committees,” (which differ from U.S. animal care and use committees primarily by name) but which, he admits, nevertheless “apply . . . standards in a speciesist manner, weighing animal suffering more lightly than potential human benefit” (4, p86). Then:

In a society that is fundamentally speciesist, there is no quick solution to such difficulties with ethics committees. For this reason some Animal Liberationists will have nothing to do with them. Instead they demand the total and immediate elimination of all animal experimentation. . . . Meanwhile the number of animals suffering in laboratories continued to grow, until the recent breakthroughs described earlier in this chapter. These breakthroughs resulted from the work of people who found a way around the “all or nothing” mentality that had effectively meant “nothing” as far as the animals were concerned. (4, pp86–78)

It is unclear to us what Singer means by “breakthroughs” here. Break-ins, perhaps?

What If There Were Only Empty Cages? What sort of world does Singer envision if “we could reach a point at which the interests of animals really were given equal consideration with the similar interests of human beings . . . [and] cages would empty and laboratories would close down” (4, p87)? Singer assures us that medical research would not “grind to a halt,” nor would we have “a flood of untested products” on the market. We would, he admits, have to make do with fewer products, but that would not be “any great loss.

But for testing really essential products, as well as for other kinds of research, alternative methods not requiring animals can and would be found” (4, p88).

Singer bases this simplistic statement on the fact that a number of alternatives to animals (more correctly, prescreens before animal testing) have been developed for product-safety testing since the printing of the first edition of his book, but

not because scientists have suddenly started to care more about animals, but as a result of hard-fought campaigns by Animal Liberationists. The same thing could happen in many other fields of animal experimentation. (4, p88).

This pronouncement ignores both the fact that it is scientists, not animal liberationists, who develop and use alternatives to animals, and the reality that there are fundamental differences between testing a product for safety (where the number of animals needed will continue to decrease as more effective prescreens are developed) and true *research*, be it either for fundamental knowledge or for clinical applications. It seems to us that Singer is simply blind when it comes to understanding how science advances. No matter how many “hard-fought campaigns by Animal Liberationists” there are, medical progress will continue to depend in important ways on animal research. Furthermore, it may never be possible to safely replace animals completely in safety testing. For example, a medical device that was recently placed into clinical usage is now having disastrous effects on patients because it was not tested adequately on animals (81).

Singer next launches into a diatribe about animal research, cigarettes, and cancer. He claims that “the proof of the connection between tobacco use and lung cancer was based on data from clinical observations in human beings” (4, p88). Unfortunately for his argument, while epidemiological data are important for demonstrating relationships and associations, they do not “prove” anything. Animal studies were necessary to prove the connection; moreover, they identified the substances in tobacco smoke that are carcinogenic (82). Next Singer rails against cancer research, with the familiar antivivisectionist cry that we are “losing the fight” against cancer. Granted, we have not yet won the battle against most cancers, but considerable progress has been made, as evidenced by the following data: In 1913, 90% of people diagnosed with cancer died of the disease. In 1960, this figure was 70%. In 1970, 60% died, while in 1990, 50% of those diagnosed will survive (83). We cannot hope to continue this progress if animal research is stopped. Another way to look at this question is to list the advances in cancer

therapy that would not have been possible without animal research (84).

Singer cites other examples where science has supposedly “failed,” including the search for vaccines against malaria and AIDS. With regard to the latter, Singer tells us that we should be testing on humans: “Why should people be dying from an invariably fatal disease while a potential cure is tested on animals who do not normally develop AIDS anyway?” (4, p90). He continues:

The defenders of animal experimentation are fond of telling us that animal experimentation has greatly increased our life expectancy. In the midst of the debate over reform of the British law on animal experimentation, for example, the Association of the British Pharmaceutical Industry ran a full-page advertisement in the *Guardian* under the headline “They say life begins at forty. Not so long ago, that’s about when it ended.” . . . The advertisement stated that “it is thanks largely to the breakthroughs that have been made through research which requires animals that most of us are able to live into our seventies.”

Such claims are simply false. (4, p90)

Singer backs up this denouncement by citing a letter to *Lancet* (85), which claimed that the ad quoted above “illustrates two major errors in the interpretation of statistics” and referred to a book by British epidemiologist T. McKeown (86). Singer also cites a later study in the United States (87). All three of these sources state essentially that medical interventions have had only marginal effects on lowering mortality from infectious diseases. Singer continues:

Remember that this 3.5% is a figure for all medical intervention. The contribution of animal experimentation itself can be, at most, only a fraction of this tiny contribution to the decline in mortality. (4, p91)

Thus, Singer puts the finishing touch on his work—capping off all those descriptions that evoked images of pain and suffering, all those reports by authors who supposedly admitted that their work was worthless—with the crowning blow against animal research: It does not save lives.

However, it so happens that there is more than one way to “misinterpret” statistics, as William Paton points out in the second edition of his book *Man and Mouse* (88). In his discussion of tuberculosis, Paton remarks that McKeown (86)

was very impressed by the fall in mortality during the nineteenth century, before medical

measures such as vaccination and chemotherapy had had their full impact, and he argued that the benefit from medical measures had been overestimated. He assessed the effect of streptomycin as follows. First, he took the death rates from tuberculosis since records began (1848). Then, because the population was always changing, he applied these rates to a standard population (that of 1901). He then computed the deaths that had occurred from 1848 up to 1971. For the years 1948–71, after streptomycin was introduced, he assumed that in its absence the death rate would have followed the trend of the previous 25 years.

The result, for the period of 1948–71, was an estimate of 51 per cent lives saved by the treatment; for the whole 123-year period from 1848, however, the saving had only been 3.2 per cent (139,836 deaths prevented out of a calculated 4,377,265). *It is this calculation, and similar treatments of other diseases and of gross mortality, that have been much stressed by critics of medical research and the pharmaceutical industry. No doubt, if one carried the research back to 1066, one could show that almost any change that took place was of trivial significance.* (88, p68, emphasis added)

Paton notes that in 1950, there were over 50,000 new cases of tuberculosis diagnosed in the United Kingdom, a number that has declined steadily to about 5000 in 1985 (88, p70). Similarly, there was a decline in the maternal death rate due to puerperal sepsis (childbed fever) from 200 per 100,000 births in 1935 when sulphonamides were introduced, to 5 per 100,000 in 1960 (88, p64). Paton gives similar encouraging data for lobar pneumonia, rheumatic fever, diphtheria, tetanus, measles, polio, whooping cough, hypertension, and childhood leukemia. According to the World Health Organization, vaccination against six common diseases prevents the deaths of 3.2 million children worldwide each year (89). Neither we nor Paton are suggesting that there are not important nonmedical reasons for declining mortality rates, including better sanitation, hygiene, and nutrition. But one should beware of statistics that fly in the face of common sense.

It should be added here that the establishment of public health measures which have improved sanitation and hygiene depended upon the proof of the germ theory of disease, and that proof was provided by the animal research conducted by Louis Pasteur, Robert Koch, and others (90, pp556–558). Furthermore, much of our knowledge about vital nutrients and healthful diets was obtained through studies on animals.

Finally, on page 91 of his chapter, Singer allows as

how “there are some fields of scientific research that will [no doubt] be hampered by any genuine consideration of the interests of animals in experimentation” and tells us that “those defending animal experimentation” mention the discovery of the circulation of the blood, insulin, polio vaccines, and the like. He also states that “opponents of animal experimentation” deny these claims, and then avers, “the controversy over the benefits derived from animal experimentation is essentially unresolvable, because even if valuable discoveries were made using animals, we cannot say how successful medical research would have been if it had been compelled, at the outset, to develop alternative methods of investigation” (4, pp91–92). (In fact, we can be fairly certain that without animals upon which to test theories—from the circulation of the blood to the germ theory of disease and beyond—we would have progressed about as we had during the Dark Ages, that is, blaming other races or nationalities of humans for our diseases or ascribing them to witchcraft or “vapors.”)

Now Singer makes a statement that, in our opinion, renders his whole agonized (and agonizing) chapter essentially pointless:

In any case, the ethical question of the justifiability of animal experimentation cannot be settled by pointing to its benefits for us, no matter how persuasive the evidence in favor of such benefits may be. The ethical principle of equal consideration of interests will rule out some means of obtaining knowledge. There is nothing sacred about the right to pursue knowledge. (4, p92)

Thus, according to Singer’s philosophy, animal research cannot be justified, no matter how little pain is involved to animals nor how great the benefits to humans. Why, then, did he expend so much effort mischaracterizing animal research and discrediting animal researchers? It appears that Singer tries to convince his readers that animal research is pointless and cruel even if they do not agree with his arguments for “equal consideration of interests” of animals and humans. The last sentence of the above quote is particularly telling with regard to Singer’s views about science.

Singer’s Selective Objections to Animal Use

In the preface to the first edition of his book (which is repeated in the second edition), Singer states emphatically that he is not “especially ‘interested in’ animals,” nor does he “love” them (1, pviii). His motivation to write on the subject of animal liberation appears to us to be based on an obsession with animal suffering. Indeed, “pain” and “suffering” are two of the most frequently used nouns in Singer’s writings. However, it would seem that he is afflicted by tunnel

vision regarding animal pain or discomfort. He devotes about one quarter of his book to agonizing over the animal suffering that supposedly occurs in U.S. laboratories and another quarter to the alleged abuse of animals in factory farms. Is this allocation of concern justifiable by the pain endured by animals in these enterprises?

Data collected by the U.S. Department of Agriculture (USDA) in 1990 show that only 4%–6% of the animals used in federally supported research (including rodents) were subjected to procedures that would cause pain or discomfort without receiving anesthetics or analgesics (Table III) (71). On the basis of the OTA estimates of animal use in research, 6% of the total would be about one million animals per year, of which over 90% were rodents.

Other data show that over 60 million bullocks and piglets were castrated during 1989 (91). Although this vivisection was invariably done without anesthesia, Singer spends only about one-half page criticizing that practice (4, pp145–146). Furthermore, more than 7 million lambs have their tails docked each year in the United States (91), and millions of sheep annually in Australia are subjected to a surgical procedure called Mulesing. The latter vivisection involves removing a patch of skin from the perianal region to prevent infestation by blowfly larvae. Tail-docking of lambs and Mulesing of sheep, procedures which are also done without anesthesia, are not mentioned in Singer's book. Thus, his objection to vivisection and animal suffering is highly selective. Apparently the pain and suffering that results from the vivisection of more than 100 million young farm animals each year in the United States, Australia, and elsewhere is of minor consequence to Singer, while the discomfort of less than one percent of that number in U.S. research laboratories distresses him immeasurably.

We believe that this selective concern is, in reality, an illustration of Singer's anti-science and misanthropic attitude. If his primary concern was genuinely with animal suffering, particularly that caused by vivisection, he would surely have focused more of his energies on the practices of tail docking, castration, and Mulesing of farm animals.

On page 222, Singer shows his disdain for his own species and his ignorance of biology in the following statement:

We rarely stop to consider that the animal who kills with the least reason to do so is the human animal. We think of lions and wolves as savage because they kill; but they must kill, or starve. Humans kill other animals for sport, to satisfy their curiosity, to beautify their bodies, and to please their palates. Human beings also kill members of their own species for greed or power. Moreover, human beings are not con-

tent with mere killing. Throughout history they [not "we"!] have shown a tendency to torment and torture both their fellow human beings and their fellow animals before putting them to death. No other animal shows much interest in doing this. (4, p222)

Singer follows this undocumented blanket condemnation of humanity with a profession of admiration for nonhuman predators such as wolves, which "almost never kill anything except to eat it" (4, p223). He ignores the fact that when wolves and other predators prey on animals, they generally begin eating their victims before they are dead or even unconscious (e.g., see Ref. 92). Humans rarely, if ever, treat animals in that way. Singer also ignores the fact that some social animals practice infanticide so that a new "alpha male" in a group may assure himself that the young will bear his genes. Other predators routinely kill more animals than they can eat (92, 93) and some, such as the shrike or "butcher bird," display their victims impaled upon spikes (sometimes while they are still alive) to show off their hunting prowess (94). Finally, Singer has obviously never observed a domestic cat outdoors. Based on the predatory activities of domestic cats in the United States (95) and Great Britain (96), it can be estimated that pet cats kill at least 10 million birds and small mammals in the U.S. *every single day*. Thus, the pampered, well-fed cats owned by animal rights activists alone probably kill more animals each year than the total number used in research during the same period.⁴ Singer also fails to point out that the "beastly" human animal is the only species that shows any concern about the welfare and even the survival of foreign species. There are, for example, no feline societies for the prevention of cruelty to small mammals and birds. Singer is clearly a speciesist—but one who discriminates *against* his own kind.

The Concept of Speciesism

The moral arguments of the animal rights (97) or Singer's utilitarian (1, 4) philosophy hinge on an obsession with animal pain and suffering. As we have discussed elsewhere, however, it is impossible for us to know how any animal perceives (as opposed to "senses") pain (98). And although most people would agree that it is immoral to cause unnecessary pain or suffering in humans or animals, these perceptions do not provide an adequate basis for developing a code of moral principles, as Singer (1, 4) and others (e.g., Ref. 97) have done. They could have used another unpleasant condition (e.g., respiratory distress from hypoxia) with equal (in)validity to develop their arguments.

⁴ Herzog H. Personal communication, 1993.

Philosopher Peter Carruthers has recently exposed the flaws of Singer's utilitarian philosophy, and offers an alternative called "contractualism," in which rational agents agree upon rules by which to live in a spirit of cooperation to assure mutual well-being of the contracting parties (99). Animals, lacking rationality, must be outside that ethical umbrella. However, contractualism would not allow wanton cruelty to animals because this would betray defects of character in the human. This philosophy provides a firm ethical base for the common-sense notions that animals cannot be considered the moral equals of humans and that killing an animal cannot be compared to killing a human, but animals should not be killed for trivial reasons.

The Biological Perspective

From a biological perspective, Singer's condemnation of speciesism is silly. All animals favor their own kind, and they show their speciesism in various ways. They prefer to mate with their own kind and social animals prefer to associate with their conspecifics. Even predators, especially social ones, preferentially prey on foreign species. Any species that did not favor its own kind would soon become extinct.

Every species must cope with the forces of natural selection that operate to drive them to extinction, and these forces are very effective. It is estimated that more than 99% of all of the species that have ever existed on earth have become extinct (100). Extinction is the rule, not the exception. Every species has some adaptive advantage or set of such advantages that enable it to resist the forces of natural selection. If these advantages are effective, the species will persist, and may avoid extinction for a time. The predator *Homo sapiens* has a set of adaptive advantages that are an expression of the functional capacities of our greatly enlarged cerebral cortex. These advantages include our capacity to reason, to develop and use languages, to think creatively and in the abstract, etc. It does not matter to what extent these higher intellectual functions may be shared by any nonhuman species. We are all obliged to use whatever faculties we have to compete with other species and with the forces of natural selection to survive as individuals and as a species.

An insatiable curiosity is one of our most important adaptive advantages. We are driven by a need to know everything we can about the universe around us—both animate and inanimate. The knowledge gained from this inquisitiveness has armed us with the ability to cope very effectively with the forces of natural selection that threaten our survival as individuals and as a species. As far as we can discern, there are four major threats to our survival as a species: infectious diseases (viral and bacterial); parasites (such as those that cause malaria and amoebic dysentery); arthropods (arachnids and especially insects); and our-

selves (overpopulation, environmental destruction, nuclear weapons). New infectious diseases (such as AIDS and Lyme disease) arise continually, and familiar ones can change and become more virulent (such as the new, antibiotic-resistant strains of the tubercular bacillus and cholera that have emerged). According to the World Health Organization, one-tenth of the world's population is afflicted with parasitic infections. Any of these could become more virulent and literally decimate the human population. Some insects and arachnids serve as vectors of diseases and they consume and/or destroy our food crops and livestock. These arthropods evolve rapidly and continually confront us with new threats.

The only hope that we have of avoiding the fate of more than 99% of all species that ever existed on this planet is to be able to use our adaptive advantages without restraint. Our need to acquire knowledge must not be encumbered by silly philosophies that are based on emotionalism and sentimentality (such as Singer's), rather than on rationality and objectivity. In order to acquire the knowledge that we will require to cope with new threats to our survival, we will need to conduct research and some of that inquiry will require the use of animals for the foreseeable future.

The condemnation by Singer and his ilk of the "exploitation" of animals by humans as immoral is both hypocritical and irrational. It is tantamount to condemning the entire practice of predation or the exploitation of one species by another even in nonconsumptive ways (such as brood parasitism as practiced by some avian species) (101). But these non-human predators are not condemned by Singer for exploiting other species even when they do so with severe brutality (92–94). Again, Singer's condemnation of speciesism is reserved for his own species (from which he tries to distance himself; see quotation from Ref. 4, p222, presented above).

Conclusions

It is our opinion that Singer is grossly distorting the truth about animal use in biomedical research, especially that conducted in the United States. Regardless of how strongly Singer feels about the use of animals for biomedical research by the military or others in the United States or elsewhere, irrespective of how much suffering that research may cause to animals, and even if the benefits that have accrued from such research were as paltry as Singer maintains, he has no moral or ethical justification to misrepresent these practices as he has done so extensively in this book, or to distort their meaning through selective quotation.

Finally, as Singer may deserve much of the credit for reactivating AV sentiments, so he must also bear some of the responsibility for the actions of the terrorist groups that have gathered under the AR/L um-

brella. Groups such as the Animal Liberation Front (ALF), the Band of Mercy, and Last Chance for Animals have claimed responsibility for vandalizing numerous laboratories and other facilities in which animals are used or housed, especially in North America and the United Kingdom. In the decade after 1980, such acts of vandalism have resulted in nearly \$8 million in damages in the United States alone (102). The terrorist faction is also responsible for threatening scientists and other animal users with severe bodily harm, torture, or death. Even the children of the targeted individuals have received such threats. In the preface to the second edition of his book (4, pxii), Singer praises the actions of some literal animal liberators but warns them against harming humans: "Some people believe that people who make animals suffer deserve to have suffering inflicted upon them. I don't believe in vengeance; but even if I did, it would be a damaging distraction from our task of stopping the suffering." These exhortations notwithstanding, however, Singer writes in a way that plays to the reader's emotions, fanning flames of indignation, revulsion, and horror in the mind of his target audience: those who already believe in the idea that animals are equal to (or better than) human beings.

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