

The Humane Society Institute for Science and Policy
Animal Studies Repository

1982

The Silver Spring 17

Andrew N. Rowan
arowan46@gmail.com

Follow this and additional works at: https://animalstudiesrepository.org/acwp_lab

 Part of the [Animal Experimentation and Research Commons](#), [Animal Studies Commons](#), and the [Politics and Social Change Commons](#)

Recommended Citation

Rowan, A.N. (1982). The Silver Spring 17. *International Journal for the Study of Animal Problems*, 3(3), 219-227.

This Response or Comment is brought to you for free and open access by the Humane Society Institute for Science and Policy. It has been accepted for inclusion by an authorized administrator of the Animal Studies Repository. For more information, please contact eyahner@humanesociety.org.



The Silver Spring 17

Andrew N. Rowan

On November 23, 1981, in a Maryland District Court, Dr. Edward Taub was found guilty under a Maryland state anti-cruelty statute of not providing adequate veterinary care for 6 of the 17 monkeys confiscated from his laboratory 2 months earlier. The case has received extensive press coverage and has also caused widespread alarm in the scientific community. According to *Science* (214:121, 1981), "scientists throughout the country have been shocked by the Taub case, initially perceiving it as a bid by antivivisectionists to procure a court ruling against animal experimentation." Taub himself has fostered this impression and has drawn a false analogy between his predicament ("victimization") and the persecution of scientists by religious authorities in the middle ages.

While the case has received extensive coverage in both scientific and animal welfare publications, there are a number of issues that have been glossed over or that have not been addressed at all. Also, most accounts have only concentrated on the events from May to November, 1981. There are some earlier incidents that should be included in the story for a full understanding of its ramifications.

Background and Events Leading to the Trial

At the time of his being charged with cruelty, Dr. Taub, a research psychologist, had been doing research on deafferentated primates for more than 20 years. (The deafferentation process involves severing the dorsal roots of the spinal nerves—the "afferent" nerves that carry sensory input from the limbs to the central nervous system. The technical term for this procedure is "dorsal rhizotomy.") His early research was conduct-

ed under the supervision of Dr. A.J. Berzman in New York and involved a study of the monkey's use of deafferentated limbs under various conditions (e.g., *Science* 128:842-843, 1958; *Exp Neurol* 7: 305-315, 1963). In the course of his work it was demonstrated that monkeys:

1. Can use a limb in a purposeful manner in the absence of sensory feedback, thereby refuting the general belief at the time.

2. Learn not to use the deafferentated limb and that this learned response can be prevented by physical restraint of the limb.

3. Can overcome some of the effects of deafferentation even when the dorsal roots are cut before birth.

4. Can learn to use deafferentated limbs even when blinded (see *Science* 199:960-961, 1978).

5. Can use deafferentated limbs only clumsily but are still capable of performing difficult movements such as picking up raisins between thumb and forefinger.

Dr. Taub moved to the Institute for Behavioral Research (IBR) in 1968. He has been Director and chief investigator of IBR's Behavioral Biology Center since 1970. Shortly after this, he received funds from the National Institute of Mental Health (NIMH) to pursue research on the "effects of somatosensory deafferentation." In 1977, the funding agency was changed to the National Institute of Neurological and Communicative Diseases and Stroke (NINCDS). According to material from the Smithsonian Science Information Exchange, funding for the project for the 4 years from 1978 to 1981 amounted to \$312,358.

Early in 1977, Jean Goldenberg, a humane society official, visited the lab-

oratory on impulse; she drove by the place daily and had wondered what was taking place. After her visit, she described it as a warehouse with inadequate sanitation, and unsuitable for housing animals. She also learned from Dr. Taub that the laboratory was not registered as a research facility with the U.S. Department of Agriculture. She notified the USDA of her findings and, following an inspection by the USDA, the laboratory was registered on February 23, 1977. Registration is a routine procedure and does not necessarily imply that the laboratory is in compliance. In fact, the USDA inspection on February 14, 1977, conducted by Dr. N.Q. Faizi, recorded a number of deficiencies:

Floors were dirty and bloodstained and with feces all over them. Much dirt and dust on the cages. Overall colony was stinky [sic]. The bottom pans were filled up with dry and wet feces up to the top. According to my experience and observations these cages had not been cleaned for over a week (USDA Memorandum, April 26, 1977).

ALEX PACHECO



An article in *New Scientist* (92:672-674, 1981), a British science magazine, notes that Fay Brisk, an associate of Jean Goldenberg's and an animal activist in Washington, reported the conditions at IBR to the National Institutes of Health (NIH). As a consequence of this action,

Jeri Phillips, a veterinarian from NIH, inspected the laboratory early in 1977. His final report noted (1) the absence of an animal care committee and consulting veterinarian, (2) fecal pans that had not been cleaned for several days, and (3) a lack of daily disease checks for the animals. Despite this, the NIH administrative officer, James Prescott, subsequently cleared Taub of the charges of neglect that were cited in Fay Brisk's letter. IBR made a few changes, such as appointing an animal care committee, including Dr. Paul Hildebrandt as consulting veterinarian, and continued with their research. It was at this point, too, that responsibility for funding the project was shifted from NIMH to NINCDS.

After the brief upheaval occasioned by Jean Goldenberg and Fay Brisk, things quickly returned to normal, except for the addition of routine and uneventful inspections by the USDA.

In the middle of May 1981, Alex Pacheco, a student and founding member of an activist group called People for Ethical Treatment of Animals (PETA), started to look for work in an animal research laboratory. According to Pacheco, he felt the need to gain first-hand experience in a research laboratory so that he would have a better understanding of animal-research procedures: Because IBR was close to his home in Silver Spring, he went there first and was taken on as a volunteer after Dr. Taub explained that they could not pay him for his work.

For the next 3 months, Pacheco had free access to the laboratory and was even given a small research project by Dr. Taub, even though Pacheco had no research experience. According to Taub, Pacheco never pointed out any deficiencies to him nor questioned any procedures, although Pacheco stated before a congressional subcommittee that he did question the apparent lack of care as well as the justification for the research project he had been given.

During these 3 months, Pacheco took

numerous photographs of the facility to document his charges of inadequate care. He also took photographs of the facility after a visit by the USDA inspector on July 13. The inspector reported that he found no deficiencies. (Dr. Schwindaman, head of the animal care section at the USDA, testified before congress that the conditions evident in the photographs he had seen did not meet USDA minimum standards.) Dr. Taub then went on vacation on August 21. In the course of the next 2½ weeks, Pacheco took five scientists, including veterinarians and primatologists, through the facilities. All five were horrified at what they saw, and signed affidavits testifying to the poor conditions.

Pacheco then approached the Montgomery County Police and presented his evidence. They agreed that IBR appeared to be in violation of Maryland's anti-cruelty statute (animal research is not exempt from the anti-cruelty code in Maryland, unlike most other states). Accordingly, the monkeys and other evidence were seized on Friday, September 11, under a search and seizure warrant. The monkeys were given a thorough physical examination by two zoo veterinarians from Chicago and San Diego and their report was subsequently used by the prosecution in the trial.

In the course of the next 4 weeks, Dr. Taub and his opponents fought for custody of the monkeys. On September 22, the monkeys were spirited away by animal activists because the judge had decided that they should be returned to Dr. Taub, pending the outcome of the trial. After negotiations between the police and the activists, the monkeys were returned to Washington and, on October 3, were handed back to IBR on the judge's order.

On October 7, the new court-appointed veterinarian, Dr. James Stunkard, told the judge in charge that, after reading the NIH report on what needed

to be done, he did not think that the IBR facilities could be adequately cleaned and that the monkeys should be moved. The NIH report was made public on the same day and noted that IBR had failed to provide adequate veterinary care, that the physical facilities were inadequate, and that on the basis of police photographs taken on September 11, the laboratory was determined to be grossly unsanitary. The report also recommended that the funding for IBR be suspended. The following day, one of the monkeys suffered a cardiac arrest, reportedly while being sutured for injuries sustained in a fight with another monkey. The judge immediately ordered the monkeys to be moved to another Maryland facility, and they were subsequently taken to NIH.

The trial, which began at the end of October, turned on the question of whether or not the deafferentated animals had received adequate care (and not on issues related to this particular type of research). All the scientists who testified (for both sides) agreed that deafferentated animals tend to mutilate their deafferentated limbs, but there was disagreement over whether or not such lesions should be treated and, if so, how they should be treated.

Dr. Taub argued that care of deafferentated monkeys requires specialized knowledge and that none of those testifying for the prosecution—the zoo veterinarians from Chicago and San Diego included—was qualified to set standards for the care of deafferentated animals. Taub also argued that monkeys are messy creatures that soil their quarters very quickly after cleaning. Judge Klavan, who heard the case, was unimpressed by these claims and professed to be deeply concerned at the lack of veterinary care—he found Taub guilty of 6 counts of animal cruelty. Dr. Taub has appealed, and his case is scheduled to be heard on June 14, 1982. In the meantime there are some claims and counter-claims that remain unresolved.

Care for Deafferentated Monkeys

Dr. Taub has consistently argued that monkeys with deafferentated limbs require special attention and care and that only a few individuals working in the field of deafferentation are knowledgeable about these special requirements. However, there are a number of contradictions and unanswered questions about this claim of Taub's.

Dr. Berman, under whose supervision Dr. Taub worked, recently noted that "improved methods of caring for deafferentated monkeys kept the limbs of animals in the present study [his own] in excellent condition" (*J Med Primatol* 7: 106-113, 1978). In an interview with *New Scientist* (92:672-674, 1981), Dr. Berman described the procedures used in his laboratory.

Dorsally rhizotomized monkeys are fitted with collars that prevent them from bringing the hand of the deafferentated limb to their mouths during the critical first 6 to 8 weeks after surgery, when hand-biting is a problem. Wounds that cannot be avoided, which occasionally result from uncoordinated movements of the insensate limbs, are washed with soap and water, annointed with an antibiotic ointment, and covered by a bandage that is changed at least every 2 days. In addition, deafferentated monkeys are liable to self-mutilate at any time after surgery if they are stressed. The wounds on the monkeys in Dr. Taub's laboratory had all occurred long after the animals had undergone dorsal rhizotomy.

In a grant application to NINCDS for a further 3-year (1980-1983) renewal of funds for his works on "effects of somatosensory deafferentation," Dr. Taub mentions the problems of caring for his deafferentated animals and notes that "many of these animals, if left to themselves, would rapidly bite off their anesthetic limbs if they were not pro-

tected in a variety of ways and bandaged one or more times each day. The extra care that deafferentated animals require also affects the cost of supplies and daily maintenance" [emphasis added].

Dr. Taub stated (in an affidavit to the court) that he has found, as a result of 24 years of experience, that bandages are "a potentially harmful method of treatment in many situations due to the unique characteristics of monkeys with deafferentated limbs." In court, he noted that he had changed his mind regarding the need for bandaging about 2 years earlier. Two veterinarians who were called in by the defense confirmed this (*Science* 215:745-746, 1982). However, we have not been able to determine whether Taub notified NINCDS of this change, which would presumably affect his cost estimates for the grant application. It is also unclear why, if Dr. Taub had decided that bandages were detrimental, at least one of the monkeys had a bandaged arm at the time of the police action and why bandaging was carried out from time to time on Dr. Taub's orders.



As noted in the editorial in this issue, Dr. Taub has also not been particularly creative about devising preventive measures to protect the monkeys. In 1973 (*Science* 181:959-960), Taub argued that some of the observed regression in mo-

tor ability of some young monkeys was due "primarily to the prolonged wearing of arm bandages which was necessitated by the tendency to self-inflict serious damage on the deafferented limbs by biting and sucking." He then developed a protective suit, which resembled fire-fighting garb. This device left the animals' arms free, but a wire-mesh visor prevented them from putting their hands into their mouths. It is not clear why such garb, with or without appropriate modifications, was no longer being used.

It therefore appears as though at least one expert (Dr. Berman) disagrees with Dr. Taub on the extent and type of care necessary for deafferented animals. Furthermore, Dr. Taub's statements and actions on the bandaging issue are inconsistent. He also admitted in court that he would not have been able to diagnose the osteomyelitis that one of the animals had developed in one arm, which later forced NIH veterinarians to amputate the limb (*Science* 214:1218-1220, 1981). In light of these deficiencies and inconsistencies, as well as the general agreement of most persons who viewed the IBR primate facilities (or the police photographs), that the facilities were filthy, rodent-infested, and "beyond any reasonable standard of acceptable untidiness which might be expected to exist in a busy laboratory" (NIH Report), Taub's claim that he is fit to care for deafferented (or any) monkeys without veterinary assistance should be dismissed as untenable.

Dr. Taub has also claimed that animals feel no pain in their deafferented limbs because the relevant sensory nerves have been cut. In addition, Dr. Rioch, chairman of IBR's Animal Care Committee, has argued that one cannot apply human expectations of pain to animal surgery "because pain is primarily a matter of societal conditioning to which animals are not subject." Dr. Rioch's belief is naive and simplistic. If it is true, all

of the animal models that have been used in the development of analgesics are invalid. Also, even if the animals have no sensation of pain from their deafferented limbs, they may still have systemic suffering since infection from the arms could still affect the rest of the body.

Other researchers in the field appear to disagree with the claim that deafferented animals feel no pain. Levitt and Levitt discuss the deafferentation syndrome at length (*Pain* 10:129-147, 1981) and note that the syndrome is also produced in dorsally rhizotomized macaque monkeys. They state that "the syndrome of rhizotomies is indicative of a chronic neuropathological pain" and even cite research by Taub on rats (*Exp. Neurol* 54:33-41, 1977) which apparently supports such an inference. What this research indicates is that the animals in Taub's experiments, although deprived of sensory innervation, may nonetheless have continued to have a very real perception of pain in those limbs, and reacted to the persistent irritation by mutilating themselves.

Four of the seized monkeys required immediate veterinary attention and, in the opinion of the zoo veterinarians, displayed conditions that had developed over a considerable period of time. There were several unhealed fractures, and the monkeys had symptoms of gross infection such as draining lesions, purulent holes, or greatly enlarged lymph nodes. One does not need much veterinary expertise to judge such conditions as unacceptable under any circumstances.

Concerning the question of the unsanitary conditions of the laboratory, Dr. Taub and some of his colleagues appear to believe that it is virtually impossible to keep monkeys in clean and sanitary conditions. For example, a colleague on the research project, Dr. Michael Goldberger from the University of Pennsylvania, stated that "I saw nothing I wouldn't expect to see if I went

around the country looking at primate colonies" (*Science* 214:1219, 1981). Dr. Taub did admit that he had a housekeeping problem during his vacation and alluded repeatedly to the fact that one technician failed to feed the monkeys or clean up on 7 of the 20 days when Taub was away, including the 2 days before the police raided his laboratory.

The NIH reviewers who found the conditions of the laboratory grossly unsanitary were, however, surely capable of distinguishing between transient accumulations of dirt and feces and cages that appeared not to have been cleaned for months. It does Dr. Taub no good to argue that the conditions in his laboratory are comparable to those in other similar facilities. Laboratory animal veterinarians and other researchers are only likely to find his comments insulting (*Lab Anim* 11(1):7, 1982).

In the 1980 grant application, Dr. Taub quotes a \$0.55 per diem cost for looking after each monkey. A further \$400 was requested for veterinary supplies. A per diem cost of \$0.55 is very low for macaque monkeys. According to Dr. O'Donnell, Acting Director of NIH's Division of Research Resources, the average per diem cost for cynomolgus monkeys ranges from \$2.50 to \$4.00 (Testimony on 1982 NIH Appropriations, House Subcommittee on Appropriations, p. 1392). It is unclear why Dr. Taub estimated such a low per diem for his cynomolgus monkeys, especially considering the extra care required, and supposedly provided, for the deafferentated monkeys.

The Responsibilities of the Attending Veterinarian

When IBR was registered as a research facility with USDA in 1977, the Institute was required to appoint an "attending veterinarian." The duties of this individual are not set out in any detail by USDA, but once a year he or she must

sign an annual report form and "certify that the type and amount of analgesic, anesthetic, and tranquilizing drugs used on animals during actual research, testing, or experimentation *including post-operative and post-procedural care was deemed appropriate to relieve pain and distress for the subject animal.*"

Dr. Paul Hildebrandt had agreed to act as attending veterinarian for IBR but, as he explained to the NIH review committee, he had always considered his role vis-a-vis IBR as that of a consultant. However, his services were not required very often: as admitted by Dr. Taub, no veterinarian had been called in to help or advise IBR for 2 years. Dr. Hildebrandt noted that, on his annual visits, the monkeys appeared to be lively but he conceded that, as a pathologist, he had had little experience with research animals of any sort, or with primates in or out of the laboratory.

It may be that "attending veterinarians" from outside the research institution provide little more than a professional rubber stamp for the relevant research facility. As far as the Animal Welfare Act is concerned, they are required to do no more than sign their name in the appropriate blank space on an annual report form. A recent editorial in the newsletter of the American College of Laboratory Animal Medicine (January, 1982) notes that it was reported that no veterinarian saw the monkeys for 2 years and that, if this is true, USDA and NIH need to review their procedures further. However, the editorial also notes that "we in ACLAM should bear some of the collective responsibility: have we pressed the AVMA for a clear statement on professional and ethical obligations in signing USDA annual reports? What does attending veterinarian mean in practical terms?"

It is indeed time to establish some sort of code of conduct for the "attending" veterinarian, perhaps encouraging more frequent attendance (monthly?) at

the laboratory as well as requiring actual supervision of the animal care staff. In addition, the attending veterinarian and others who sign the annual report forms should be more aware of their specific legal responsibilities.

The Role of the USDA and the NIH

From the time that the animals were seized from his laboratory by the police, Dr. Taub has consistently claimed that he was merely maintaining what, he thought, were acceptable standards of care. His opinion about this had been corroborated by the results of the USDA and NIH inspections. After the initial inspection by Dr. Faizi, the USDA inspector consistently noted no, or only minor deficiencies. Dr. Perry had taken over from Dr. Faizi and it was clear from Perry's performance in the courtroom that he had little knowledge of, or interest in the Animal Welfare Act regulations. As a further wrinkle, APHIS officials admitted during congressional testimony that the photographs of the laboratory which they had seen did not indicate compliance with the regulations. At NIH, despite Dr. Phillips' unfavorable report in early 1977, subsequent reports noted that "the facilities for the research are well suited for the proposed project" (1/11/79) and that "the facilities for the behavioral work have been built up over many years and are excellent" (10/18/79).

Not unjustly, Dr. Taub asks why NIH has suddenly decided that his facilities are inadequate when they have considered them to be satisfactory for the past 9 years. Part of the answer may be found in testimony from Dr. J. Simms, who visited the facility in February 1979 to review the research for NIH. She noted that her comments (see above) in the report referring to the facilities were merely routine and that the animal quarters had not been specifically inspected.

At the October congressional hearings on animal experimentation, Dr. William Raub of NIH was given a particularly tough grilling by congressmen on the question of how IBR had escaped detection. Under their questions he admitted that the system had failed and announced that NIH intended, in the future, to include animal care as a responsibility of site visit teams. They also planned to make unannounced surprise visits to randomly selected institutions to protect against a similar occurrence.

The evidence clearly indicates that both the USDA and NIH were given due notice that there might be problems at IBR. However, neither followed up on the early reports. Pacheco cannot be faulted for not taking his observations and concerns to NIH or USDA. Their past record did not give him any reason to believe that they would have taken firm action to correct the situation. On the other hand, once they had been made publicly aware of the situation, NIH officials proceeded with commendable speed and suspended Dr. Taub's grant after satisfying themselves that there was cause for serious concern. The USDA, on the other hand, displayed customary indecision when confronted with yet another problem in a registered research laboratory. They now claim to be revising their inspection procedures to prevent a further occurrence of this sort and have also undertaken a review of the other laboratories inspected by Dr. Perry.

The Scientific Issues

While the actual case has turned *solely* on the quality of the care provided to the animals, Dr. Taub has attempted to strengthen his position by referring to the scientific value of his work. For example, in an affidavit to the court, Dr. Taub notes that the seizure of the monkeys represented not an attack on his lab in particular but "an overall attack

on medical research as it is conducted throughout the world today." In fact, this allegation is supported by Pacheco's own comments. After Dr. Taub's conviction, PETA issued a statement to the press which notes that Pacheco viewed the legal victory as a stepping stone. He is quoted as saying that "now we must face the question of whether it is justifiable to use animals in experimentation at all." However, Pacheco's intentions in bringing the case against Dr. Taub do not affect the merits of the case one whit. Nevertheless, several of Taub's colleagues have pursued this red herring and have already established the Biomedical Research Defense Fund to support any scientists who find themselves the targets of similar protests by animal activists.

As for Dr. Taub's own work, it has been lauded by several scientists. Dr. John Basmajian, Director of Rehabilitation Medicine at Chedoke-McMaster Hospital in Hamilton, Ontario, has stated that "Dr. Taub's findings have greatly clarified mechanisms of recovery and motor retraining and continue to provide clinicians with improved understanding of the potential for neuromuscular recovery..." (*New York Times*, October 6 1981).

However, Taub himself notes of one of his discoveries, that of learned nonuse of the deafferentated limb, that "the long-enduring component of motor impairments following CNS damage in humans is frequently due to motivational and learning factors" (1980 Grant Application Renewal). Thus, his results in animals support and confirm observations already made in humans (a not uncommon result of animal research) although his data also suggest new kinds of clinical therapies that appear to have some potential.

Despite Taub's supporters, who affirm that his research contributions have been gained "at a relatively small price

in terms of animal suffering" (*Baltimore Sun*, November 9, 1981), there are some legitimate questions that can be asked about the approach used in the kind of research performed by Taub.

Dr. Taub's 1980 renewal grant application proposed studies that would attempt to quantify the deficit in movement and learning produced by brachial dorsal rhizotomy. One could criticize this as mere parametric tinkering, because so much of the neuronal mechanism of control of movement in deafferentated limbs is unclear at this time. Quantitative measures are unlikely to clarify the situation. As the Neurological Sciences Study Section noted in turning down another Taub grant application for research on fetal origins of sensory motor integration, "The issues under attack here are poorly understood...is it appropriate to pursue studies requiring extraordinary surgical manipulations on few animals at great expense?" (December 20, 1979). Certainly, there are many things that can be measured, but that does not mean that they *must* be measured.

A fairly large proportion of the proposed behavioral tasks described in the funded Taub project involved prehension tests that required the animal to use its fingers. However, the veterinarians who inspected the monkeys after the police seizure recorded that 39 of 55 digits on the deafferentated limbs were either missing or deformed. Presumably, Dr. Taub would have had to submit yet more monkeys to dorsal rhizotomy in order to study the prehension tasks proposed for the next 3 years. From our point of view, the need to use more animals would largely be the result of poor postoperative care and thus cannot be justified.

Conclusion

Apart from the fact that animal research laboratories are now likely to be more careful in their hiring of part-time

summer help, what has been learned from the case of the "Silver Spring 17"?

First, it is clear that the Animal Welfare Act does not necessarily ensure satisfactory standards of care and housing for research animals (even assuming that a bare 15-ft³ cage is a satisfactory home for a monkey). It is also clear that NIH's much-touted *Guide for the Care and Use of Laboratory Animals*, even when supported by their other mechanisms for maintaining standards, did not guarantee adequate care or housing. NIH is currently looking at ways to upgrade their animal welfare programs, but these are unlikely to allay the concerns of animal welfare organizations as long as representatives of the concerned public are excluded from any form of oversight or participation.

Second, it is not appropriate to ignore wounds and lesions on laboratory animals, regardless of whether or not the animals feel pain. If scientists do research where the animals are likely to self-mutilate or injure themselves for whatever reason, then there must be an earnest and continuing search for solutions to the problem.

Third, under the Animal Welfare Act, institutions which do not employ a veterinarian full-time to care for the laboratory animals must obtain the ser-

vices of an "attending" veterinarian. It is clear that the duties and responsibilities of the attending veterinarian need to be described in more detail. Perhaps certification by the American College of Laboratory Animal Medicine should be a requirement for all attending veterinarians.

Finally, the problem of weighing the scientific questions against the ethics of animal research will always be with us. This case has not helped to advance the quality of the debate, although it has served to alarm a significant number of biomedical researchers. The revelations of the case also encouraged congress to address the question of regulation of animal research with more commitment and served to destroy the usual defense put forward by NIH and USDA—namely, that their standards are sufficient to safeguard the welfare of laboratory animals.

The 1966 Laboratory Animal Welfare Act was passed, in part because a stolen dog ended up in a laboratory and a *Life* reporter did an expose of the prevailing conditions in dog dealer facilities. Perhaps the Taub case will stimulate further congressional action to regulate laboratory animal welfare.

(An editorial comment on the Taub story is featured elsewhere in the Journal.)

FORTHCOMING ARTICLES

Alternatives to Animal Experimentation—Steven Niemi

Deep Woodchip Litter: Hygiene, Feeding, and Behavioral Enhancement in Eight Monkey Species—Arnold S. Chamove et al.

Abundance and Distribution of Large Mammals in Upper Ogun Game Reserve, Oyo State, Nigeria—T.A. Afolayan et al.

The Future of Research into Relationships Between People and Their Animal Companions—Boris M. Levinson

Historical Trends in American Animal Use and Perception—Stephen Kellert and Miriam O. Westervelt