

Chimpanzees in Research: Past, Present, and Future

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CHAPTER

Kathleen M. Conlee and Sarah T. Boysen

Introduction

Chimpanzees have been used in research in the United States since the 1920s (Brent 2004), with their breeding and use highlighted in the 1980s as a model for acquired immune deficiency syndrome (AIDS) research. However, the use of chimpanzees in harmful research has come to be questioned throughout the world, based on both ethical and scientific concerns. Public support for chimpanzee research has been declining over time (National Science Board 2002), costs of using chimpanzees in research have been rising, the number of chimpanzees in laboratories (including in the United States) has been declining, and legislation and policies prohibiting the use of great apes in research have been on the rise internationally. These trends may indicate an end to the use of chimpanzees in research in the United States and abroad in the near future. Other than increased attention to the use of chimpanzees in research, animal protection groups, conservationists, lawyers, and others are focusing on issues related to chimpanzees as well, including their use in entertainment, hunting of them in the wild for food (known as “bushmeat”) and the pet trade, general

conservation issues, and pursuit of their legal rights (Cavalieri and Singer 1993; Wise 2000, 2002).

Why is there particular interest in the use of chimpanzees in research? They are the only apes (of both great and small) used in biomedical research and testing in the United States, and much has been learned about their emotional lives and intelligence over the last several decades.¹

Although the welfare of chimpanzees encompasses many issues, this chapter addresses their use in research, including their historical and current use in the United States, ethical and scientific concerns, public opinion, international legislation, and future directions.

The Species Chimpanzee (*Pan troglodytes*)

Chimpanzees are members of the taxonomic order primates and the great ape family (*Pongidae*), which also includes gorillas (both lowland and mountain subspecies), orangutans, and bonobos (formerly referred to as pygmy chimpanzees). The natural habitat of the chimpanzee is a range of countries

across equatorial Africa, from Senegal, Mali, Sierra Leone, Côte d’Ivoire, Ghana, Nigeria, Cameroon, and Gabon in West Africa; the central African countries of Congo, Equatorial Guinea, the Central African Republic, the Democratic Republic of Congo, Uganda, and Burundi; and Tanzania in east Africa. Chimpanzee social structure has been observed to include nearly every type of relationship seen among different primate species, including multimale or multifemale groups, bachelor groups, male/female breeding pairs, a mother and her infant, or a female and her offspring of various ages.

In general, chimpanzee social organization is described as a fission-fusion society, with individuals or small groups leaving and then periodically rejoining the group. Like many primate species, chimpanzees give birth to a single infant, who may nurse for four to five years, so the offspring have an extended period of maturation and learning. Males remain in their natal group for their entire life, while females of reproductive age emigrate and take up residence in neighboring communities. These sex-related behavioral strategies thus serve as a natural incest taboo

and help maintain genetic diversity within and among different chimpanzee groups in a given area. Male chimpanzees maintain order and position in their groups through a dominance hierarchy and often form coalitions of two to three males who co-rule the group. Females, however, are not as social with other females as males are with males, although a dominance structure does exist among them. Exceptions have been observed, even to the point of a female who participated in cooperative hunting with the males of her group, although most of such opportunistic predation on small mammals (including monkeys such as the red colobus) has typically occurred among all-male groups.

Like many nonhuman primates whose habitats are being encroached upon, the chimpanzee is listed as “endangered” in the wild under the U.S. Endangered Species Act. Some estimates are that only 110,000 animals remain across Africa. However, unlike any other species on the list, the chimpanzee is the only species that is cross-listed as “threatened” in captivity, thereby given less protection from certain types of biomedical and invasive research. Consequently, the “threatened” status of the captive population permits procedures and other activities that are not legally permitted with wild chimpanzees. If chimpanzees were listed solely as endangered, the types of research that are currently allowable could simply not be done. Currently, only a few countries other than the United States, including Gabon, Liberia, and Japan (although a ban is in preparation there), permit biomedical research on chimpanzees. Chimpanzee research is not permitted in the United Kingdom, Sweden, Australia, New Zealand, or the Netherlands (although not formally declared by each country, no European Union countries conduct research on chimpanzees).

Chimpanzee Intelligence

Cognitive and behavioral research with chimpanzees, including both field studies and captive work over the past forty years in particular, have taught us much about the remarkable capabilities chimpanzees share with humans. These include:

- An extensive list of some thirty-nine-plus types of tool use in the wild (e.g., Goodall 1968; McGrew 1992; Whiten et al. 1999)
- Complex processing capacities for acquiring concepts such as “same vs. different” (e.g., Premack and Premack 1983)
- Numerical skills, including counting abilities, that are comparable in chimpanzees’ development as they are in young children (e.g., Boysen and Berntson 1989; Matsuzawa 1985a)
- Productive use and comprehension of symbolic language-like systems of several types, including signed English based on American Sign Language, visual symbol systems such as plastic shapes that stand for words, or graphic symbols that are computer-interfaced to display the word-like symbols chosen and the order in which they have been selected (e.g., Matsuzawa 1985b; Premack 1986; Savage-Rumbaugh 1986; Gardner, Gardner, and van Cantfort 1989)
- Extensive skills with problem solving of all kinds observed in both the wild and under experimental conditions in captivity (e.g., Matsuzawa 1985b; Limongelli, Boysen, and Visalberghi 1995; Kuhlmeier and Boysen 2002)
- Recognition of kin relationships based on comparing photographs alone of chimpanzees and their offspring (Parr and de Waal 1999a)

- Studies that suggest chimpanzees, like humans, understand that other chimpanzees may have the same or different set of beliefs, desires, and knowledge from their own, a capacity formerly believed to be unique to humans (e.g., Hare, Call, and Tomasello 2001; Tomasello and Call 1997).

Clearly, the evidence demonstrates that the chimpanzee is a species whose genetic, morphological, anatomical, neurological, biochemical, behavioral, and cognitive similarity to humans is unique among all other species living today.

Chimpanzee Emotions and Motivation

During the past several decades, much has been learned about the chimpanzee’s motivation and capacity for emotional expression. Empirical studies under controlled conditions in captivity have documented that the emotional range of chimpanzees is quite comparable to that observed in humans, with considerable overlap in facial expressions (Parr, Dove, and Hopkins 1998; Parr 2001, 2003). These include expressions exhibited during laughter; under conditions of fear, anger, or sadness; and a range of grimaces observed in human neonates, such as disgust or pleasure in response to odors and/or taste.

Observations in both wild and captive settings suggest that chimpanzees are subject to some of the same types of behavioral and emotional pathologies as have been observed in humans, including depression, various neuroses, anxiety, and even grief to the point of death (Goodall 1986). It is typically easy, especially for young children, to watch chimpanzees in a zoo or sanctuary and recognize that the animals are playing tag or play-fighting or that a disagree-

ment has occurred between animals, with resultant real fighting. The overlap among behavioral and emotional expressions between humans and chimpanzees is quite dramatic, such that even very young children are able to interpret often complex social interactions among chimpanzees quite accurately. (There are notable exceptions, however, such as differences in the two species' respective "smiles"—a chimpanzee "smiling" with upper and lower teeth showing is expressing fear, for example.)

The History of U.S. Chimpanzee Research: 1920–1979

Chimpanzee research began with the work of Robert M. Yerkes of Yale University, who established a laboratory at his rural home in the early 1920s with two purchased chimpanzees (Yerkes and Learned 1925). His early writing about these animals, a male and a female, explored a wide range of behavioral and intellectual capacities observed both directly and indirectly as the young chimpanzees developed. He was particularly interested in and wrote fairly extensively about the differences he noted between the two animals and, at the time, attributed such to sex differences. However, it was later confirmed that Yerkes actually had one chimpanzee (*Pan troglodytes*) and one bonobo (*Pan paniscus*), so many of the differences he attributed to sex may actually have been species differences. This was particularly notable with respect to differences in vocalizations, although many other behavioral traits were also confounded by reporting them as sex rather than species differences (Yerkes and Learned 1925). Despite this misguided start, Yerkes and his wife contributed several of the first descriptions of chim-

panzee behavior, including a range of observations that included social interaction, play, sexual activity, diet, morphology, anatomy, emotional states, facial expressions, vocalizations, and intelligence.

Yerkes's work was critical to the emergence of primate studies in the United States. His burgeoning laboratory moved first to Orange Park, Florida, in 1930 and then to Emory University in Atlanta, Georgia, in 1965 where, as the Yerkes National Primate Research Center, it remains today (Yerkes National Primate Research Center n.d.). In addition to his numerous books on apes, including chimpanzees, Yerkes contributed a wealth of scientific papers to the emerging literature. Yerkes's books and journal articles remain an important source for researchers, particularly for those whose interests are in chimpanzee cognition and behavior. He was the first to study many phenomena in chimpanzees of great importance to the field of primatology and is considered to be one of the fathers of primatology in the United States.

In the 1940s the focus at Yerkes National Primate Research Center shifted from the study of behavior to the study of infectious disease (Committee on Animal Models in Biomedical Research 1995). The use of chimpanzees for the study of infectious disease has increased ever since, particularly in hepatitis and human immunodeficiency virus (HIV), and continues at a number of facilities (Table 1).

In the 1950s the U.S. Air Force created a research and breeding program with sixty-five wild-caught chimpanzees to determine the effects of space flight on humans (Brent 2004; Save the Chimps n.d.). The aeronautics research involved subjecting chimpanzees to a number of stressors during training as well as the obvious stressors associated with being launched into space. These stressors included exposure to G forces, loss of consciousness in decompression cham-

bers, spinning in giant centrifuges, and use of shock as punishment while training (Save the Chimps n.d.). In January 1961 a chimpanzee named Ham was placed on a ballistic trajectory flight and forced to perform a motor task throughout the flight for which he had been trained. In November 1961 a second chimpanzee, Enos, orbited the earth twice and was forced to perform a more complex task (NASA 2004). Unfortunately, through a malfunction in equipment, Enos received a shock for every correct maneuver he made, which contradicted the 1,263 hours of training he had undergone (NASA 2004; Save the Chimps n.d.); despite the shocks, Enos continued to complete the task correctly.

After some Air Force chimpanzees were sent into space, they were reassigned to other projects, such as testing seat belts. In the 1970s the Air Force no longer used chimpanzees but did lease them out for biomedical research studies (Save the Chimps n.d.). In 1975 the Convention on International Trade in Endangered Species (CITES) was adopted, which greatly restricted importation of chimpanzees from the wild. This prompted a captive-breeding effort within the United States, which has been federally funded since 1986 (Brent 2004).

Chimpanzee Research: 1980 to the Present

AIDS Research in the 1980s

During the 1980s there was a drastic increase in chimpanzee research, primarily prompted by the human AIDS epidemic. A massive breeding effort was launched in 1986 (National Research Council 1997), and in 1992 scientists representing animal welfare and AIDS research interests met to discuss

Table 1
U.S. Facilities Housing Chimpanzees:
Types of Research and Numbers of Animals

Facility*	Location	Type of Research	Total Number of Chimpanzees	Number of NCRR-Supported Chimpanzees ³
New Iberia Research Center	New Iberia, La.	Breeding, vaccine research, drug efficacy	350 ¹	130
Alamogordo Primate Facility	Alamogordo, N.M.	Behavioral	275 ¹	270
Southwest National Primate Research Center	San Antonio, Tex.	Vaccine and drug testing, hepatitis, Alzheimer's, HIV	250 ¹	15
Yerkes National Primate Research Center	Atlanta, Ga.	HIV, behavioral, neuroscience, reproduction	197 ¹	75
M.D. Anderson Cancer Center	Bastrop, Tex.	Breeding colony, hepatitis, infectious disease	154 ¹	105
Primate Foundation of Arizona	Mesa, Ariz.	Behavioral, reproductive, research supply	75 ¹	74
Bioqual	Rockville, Md.	Hepatitis, respiratory viruses	63 ²	Not mentioned
Centers for Disease Control and Prevention	Atlanta, Ga.	Hepatitis	14 ²	Not mentioned
Food and Drug Administration	Rockville, Md.		11 ²	Not mentioned
Ohio State University	Columbus, Ohio	Behavioral, cognitive (noninvasive)	11 ¹	0
Language Research Center, Georgia State University	Decatur, Ga.	Behavioral (noninvasive)	4 ²	Not mentioned
Chimpanzee and Human Communication Institute, Central Washington University	Ellensburg, Wash.	Behavioral (noninvasive)	4 ²	Not mentioned

*This is not meant to be an exhaustive list of the types of research being conducted at each facility.

¹ According to the *International Directory of Primatology*.

² According to Goodall et al. 2003.

³ According to a presentation given by J. Strandberg at the American Association of Laboratory Animal Science (AALAS) conference in 2003. The remaining chimpanzees are not federally owned, but the facilities may still receive federal funding for research.

the use of chimpanzees in human immunodeficiency virus (HIV) research (van Akker et al. 1993). At that time, the group acknowledged there were some areas of HIV research for which chimpanzees were not necessary, such as prevention of maternal-infant transmission and physiological safety tests for vaccine development. The group advocated for alternatives, such as using monkeys, but it emphasized that some of the suggested approaches engendered animal welfare concerns as well. The group considered other factors related to HIV research on chimpanzees, such as housing conditions, and concluded that not allowing chimpanzees in HIV research to interact socially with other chimpanzees or humans “is both unnecessary and unethical” (van Akker et al. 1993). The group advocated the use of environmental enrichment (innovative ways to enrich the lives of chimpanzees that promote natural behavior) and housing that allows the chimpanzees to express natural locomotor behaviors.

It is not known whether HIV survives in chimpanzees, but we do know that the animals do not develop the AIDS-related complex seen in humans (Balls 1995; Nath, Schumann, and Boyer 2000). There is, however, a specific strain that is pathogenic in chimpanzees and typically takes up to ten years to progress to AIDS-like symptoms. Great controversy has arisen over whether chimpanzees should, in fact, be challenged with that particular strain (Nath Schumann, and Boyer 2000). Some members of the research community have strongly opposed the idea, some publicly (Prince et al. 1999). Over time, however, it has been determined that the chimpanzee is a poor model for HIV research, and some researchers argue that the use of chimpanzees is not likely to lead to a cure for AIDS (Reynolds 1995). Despite this, HIV-related research in chimpanzees continues.

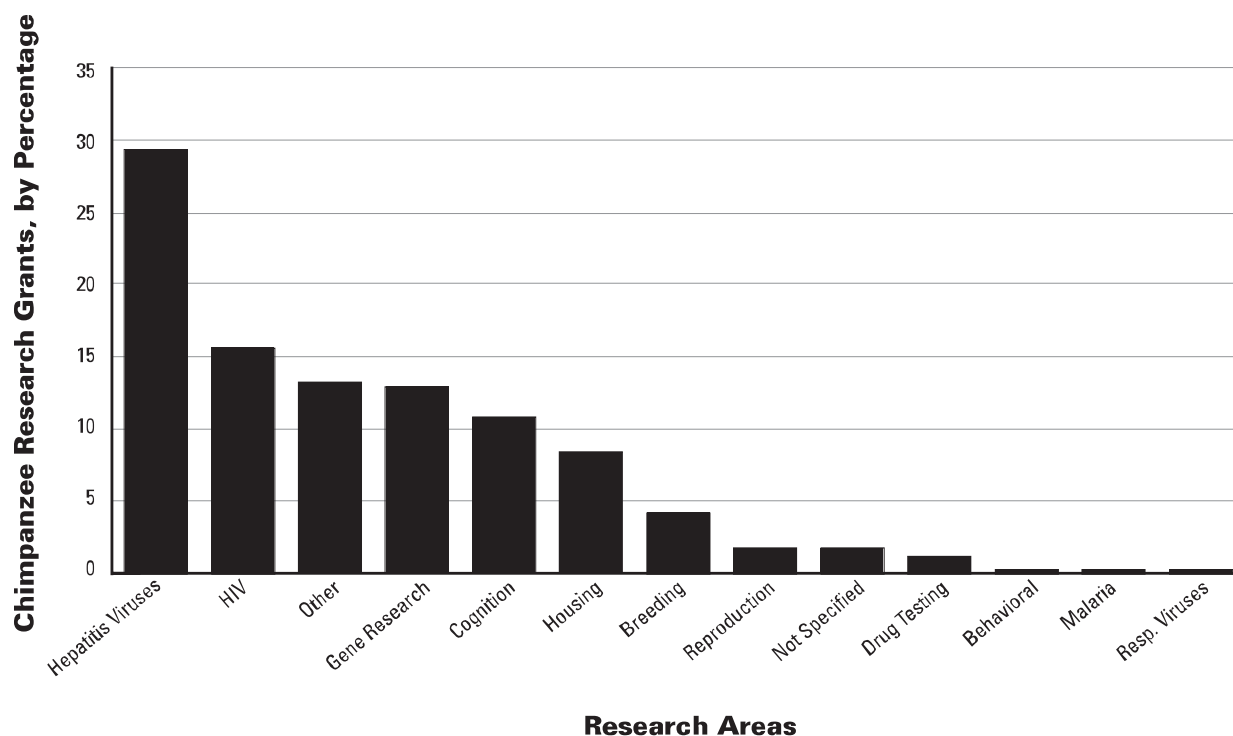
The Humane Society of the United States (HSUS) examined U.S. Public Health Service (PHS)-funded grants that involved captive chimpanzees in HIV research in some way (including breeding for HIV research), beginning in 1980.

Some grants extended over as many as twenty-five years; therefore, data for each year reflect both ongoing research and newly funded projects. In 1980 three PHS-funded studies involved the use of chimpanzees in HIV-related research.

Table 2
Public Health Service-Funded Grants:
HIV Research Involving Captive
Chimpanzees

Year	Number of Grants	Types of HIV Research
1980	3	Receptors Vaccine safety Chimpanzee housing
1984	5	Receptors Vaccine safety Chimpanzee housing Transmission of HIV
1988	17	Receptors Vaccine safety Chimpanzee housing Transmission of HIV Vaccine efficacy Chimpanzee breeding/management
1992	18	Receptors Vaccine safety Chimpanzee housing Transmission of HIV Vaccine efficacy Chimpanzee breeding/management Immune response
1996	20	Receptors Vaccine safety Chimpanzee housing Transmission of HIV Vaccine efficacy Chimpanzee breeding/management Immune response HIV progression and pathogenesis Genetic inoculation
2000	23	Receptors Vaccine safety Chimpanzee housing Transmission of HIV Vaccine efficacy Chimpanzee breeding/management HIV progression in young chimpanzees Infection with strain most virulent in chimpanzees Cell-based immunotherapy
2004	7	Chimpanzee breeding/management Gene expression in infected chimpanzees Vaccine development

Figure 1
Chimpanzee Research Grants, 2000–September 2004



This number increased to five grants in 1984 and jumped to seventeen in 1988. The next few years resulted in an increase in these grants, to twenty-three in 2000, but this number fell to seven grants in 2004 (Table 2). As of 2001 150 chimpanzees had been infected with various strains of HIV, but only four had had evidence of “progressive HIV infection,” and one of the four had progressed to AIDS (Muchmore 2001). AIDS research on chimpanzees (including colony maintenance) has been conducted primarily at Yerkes National Primate Research Center (Atlanta, Georgia), Southwest National Primate Research Center (San Antonio, Texas), New Iberia Primate Research Center (New Iberia, Louisiana), and the M.D. Anderson Cancer Center Science Park (Bastrop, Texas) (Table 2).

Chimpanzees and Research Facilities in the United States

According to Stephens (1995), there were approximately 1,800 chimpanzees in fourteen biomedical and behavioral research facilities in the United States in 1993. In 2001 a National Institutes of Health (NIH) report to Congress identified 1,584 chimpanzees, including 614 who were government owned, who may have been used in federally supported or conducted research and were housed in thirteen biomedical and behavioral research facilities in the United States (National Center for Research Resources 2001). Since that time approximately 266 chimpanzees formerly owned by a biomedical research facility in Alamogordo, New Mexico, were transferred and are now being cared for by a sanctuary organization based in Florida. It was estimated that there were approximately 1,300 chimpanzees in twelve facili-

ties in the United States as of 2005. Table 1 provides a list of research facilities that as of 2005 housed chimpanzees, some areas of research conducted at each facility, and the number of chimpanzees (if known) at each facility. The majority of captive research chimpanzees are housed at six biomedical facilities. Information regarding the number of chimpanzees and chimpanzee research facilities in the United States was also supported by a census conducted and reported by the Great Ape Project (Goodall et al. 2003).

A review of the literature published during 2001 and included in the National Library of Medicine and PrimateLit databases revealed that of the 4,411 studies worldwide involving nonhuman primate research, nine involved the use of apes (Carlsson et al. 2004). Overall, it was estimated that 41,000 primates were used, although the specific number of great apes represented

by these studies is unknown, particularly because not all publications specify the number of animals used (Carlsson et al. 2004). Some studies, particularly those from private-sector organizations such as pharmaceutical companies, are not published (Carlsson et al. 2004) at all. These data suggest that a review of the published literature may not produce reliable information about the actual number of chimpanzees used in research, consequently requiring reliance on other sources of information.

Research in Which Chimpanzees Are Used

Chimpanzees are most commonly used for hepatitis (particularly hepatitis C) and HIV/AIDS research. A total of 334 federally funded grants between 2000 and 2004 involved the use of live chimpanzees, with approximately 29 percent related to hepatitis research and 16 percent related to HIV/AIDS research. Stephens (1995) reported that approximately 80 percent of research conducted on chimpanzees in the early '90s was related to hepatitis and HIV/AIDS. Therefore, these types of biomedical research with chimpanzees are not as prevalent as they are in the recent past, although such invasive studies continue.

Other areas of research for which chimpanzees are currently used include cognitive and behavioral studies, as models for human reproduction, malaria, gene therapy, respiratory viruses, Crohn's disease, drug and vaccine testing, and a variety of other infectious diseases (Figure 1). Experiments in some of these areas, such as studies of certain strains of HIV, can lead to severe appetite and weight loss, lethargy, diarrhea, severe illness, infections, and/or eventual death. Procedures such as major surgery, liver biopsies (required for some protocols in hepatitis research and involving multiple biopsies), frequent blood sampling, and restraint

can also cause pain and distress. Invasive research, in general, raises particular concerns regarding chimpanzee welfare in captivity.

Chimpanzee Housing and Care

Individuals who have worked closely with chimpanzees in research report that those used in many invasive protocols are typically housed alone in cages required by USDA standards to be only five feet by five feet by seven feet, with twenty-five square feet of floor space. This can be compared to the interior of an elevator (Figure 2). Cages are typically constructed from steel and, in some cases, include a perch for resting or sleeping. Many cages also have a "squeeze back," a moveable interior wall that can be pulled from the back of the cage toward the front and can press or hold a chimpanzee closer to the front of the cage so that a technician, veterinarian, or researcher can administer injections or perform other procedures without anesthetizing the chimp. Under some conditions, housing areas do not have any natural light, and the animals live under artificial lighting (light/dark) cycles at all times.

In the wild, chimpanzees are very social and live in complex groups of varying sizes. Therefore, social housing is almost certainly the single most important factor for chimpanzee psychological well-being (National Research Council 1997). Individual housing can lead to profound depression, increased aggression, psychological withdrawal, extreme frustration, and self-mutilation, such as physical wounding, hair plucking, rocking, and other psychotic-like behaviors. Chimpanzees who are not being used in active research protocols typically are housed in pairs or social groups. The physical environment for social housing can range from a cage that is slightly larger than the individual cage depicted in Figure 2 to large outdoor enclosures where the ani-

mals live in large social groups of eight to 20 individuals. The type of housing used depends on the particular institution and the type of research being conducted. Chimpanzees who live in groups also can be separated for a period and placed on research protocols that involve single housing. The likelihood of this depends on several factors, including the specific institution, the type of research conducted there (whether study animals could infect others if they were housed together), and precedents within the institution that may not be necessary for the specific study but instead reflect the culture of the institution.

An analysis of chimpanzee research for the years 2000 to mid-2002 conducted by The HSUS revealed that information about the types of housing provided in publications or in federal grant abstracts was lacking (Conlee, Hoffeld, and Stephens 2004). Among 189 publications 24 percent mentioned social housing and 76 percent did not mention any specific housing type. Overall, information regarding the specific number of chimpanzees maintained in each type of housing (individual vs. social) was not readily available. Housing and environmental conditions, however, can have significant effects on research



Figure 2. A typical laboratory cage for individually housed chimpanzees.

results, so such information should be included in all publications. Regardless of whether housing information is available, Balls (1995) raises an important point: it may be impossible to provide housing in laboratories that truly meets the physiological and behavioral needs of chimpanzees under captive conditions.

Funding for Research

The HSUS analysis of federally funded great ape research found that \$20 million to \$25 million dollars of federal funding per year is devoted to chimpanzee research and care (Conlee, Hoffeld, and Stephens 2004) (Figure 3). Hepatitis research accounts for \$4.2 million of this funding each year, and HIV research accounts for approximately \$500,000. The amount of private-sector funding for chimpanzee research is not available to the public; however, the use of chimpanzees by the private sector may be on the rise. A chimpanzee researcher sitting on a panel at the 2003 American Association of Laboratory Animal Science conference indicated that 75 percent of private-sector growth (particularly pharmaceutical companies) at the New Iberia Research Center was due to requests for chimpanzee use.

It is estimated that it costs \$20–\$30 a day to care for a chimpanzee in the laboratory and \$15 a day to care for one—better—in a sanctuary. Compare the \$9.5–\$14.2 million a year to care for the United States' 1,300 chimpanzees in a laboratory to the \$7.1-million-a-year cost of sanctuary care. It is important to emphasize that the sanctuary setting not only costs less per chimpanzee per day, but also can provide a much more naturalistic and stimulating environment.

Ethical Questions and Responsibilities

The United States currently uses more chimpanzees in biomedical research than any other country in the world. The U.S. government provides more funding for the study of chimpanzee cognition and behavior than does any other country. Results from studies over the past four decades in particular have provided a wealth of scientific evidence showing that chimpanzees and humans bear striking similarities. While we have known for up to two hundred years that the anatomy, physiology, morphology, biochemistry, and genetic overlap between chimpanzees and humans is overwhelming, it has only been within the last forty years that demonstrations of chimpanzee cognitive abilities and behavior, including a wide range of emotions evoked by chimpanzees and human beings in similar situations, have been reported from field studies (e.g., Goodall 1968) and captive work (e.g., Washburn and Rumbaugh 1992; Brown and Boysen 2000). Recent technological advances have allowed direct comparisons at the neuroanatomical level between the two species, with notable correspondence between a significant number of neuroanatomical structures that likely support the same functions (e.g., Cantalupo, Pilcher, and Hopkins 2003; Hopkins and Cantalupo 2004).

With more than thirty years of direct interactions with chimpanzees as part of a comparative cognition project, one author (S.B.) (2000) reports that her chimps have shown a number of behaviors suggesting that they were responding to natural events such as wind or thunderstorms with great fear. A similar response was likely felt by early humans, who subsequently created myths and legends to explain these phenomena. When a chimpanzee lost a

tooth and the chimp's loud alarm calls drew the other chimps to the scene, the group's response—raucous calls and all members peering at the tiny white tooth on the ground—clearly suggested that the group interpreted the pain and blood loss as caused by the tooth itself as an animate object.

One author (S.B.) and her students have observed their subjects readily sharing food with younger chimps, assisting older animals having difficulty moving from place to place in the facility, and responding with “reverence” to the body of a group member who had died of natural causes. In the last instance, the dead chimp's cage mate picked up a blanket, covered the dead chimp's head, and then placed a second blanket over her body. A videotaped record of these events leads an observer to the conclusion that the “friend's” response was intentional and empathetic (S.B., personal observation 2003). Goodall (1968) reports similar behaviors to those described above among wild chimps, suggesting that captive chimpanzees are not acquiring behaviors unseen in the wild. Long-term observations of chimps in the field and captivity have increasingly complemented and confirmed a range of comparable behaviors that are seen in humans as well as in the chimpanzee. Observations of behaviors of this level of sophistication and complexity raise difficult ethical and moral questions about the types of research on chimpanzees that are permitted in the United States.

More detailed studies of the similarities between human and chimpanzee behavioral and emotional responses are even more telling. Parr and de Waal (1999b) provided captive chimpanzees with photographs of chimpanzees they didn't know and found that the chimpanzees were not only able to match two different photographs of the same individual, but also to

match mothers and sons. This demonstrates that chimpanzees are capable of identifying similarities in the faces of related individuals who were unfamiliar to them.

In another test by Parr and De Waal, chimpanzees were presented with sample head-shot photographs of chimpanzees. The subjects recognized the emotional expressions of the chimpanzees in the sample photographs and matched them to photographs of novel chimpanzees showing facial expressions that depicted the same emotional state. The subjects chose the photograph that best matched the sample chimpanzee's picture, based on the underlying meaning of the facial features and configuration, since the perceptual and physical features were not precisely the same.

Such trials underscore chimpanzees' capacity for empathetic responses. Such responses, coupled with the cognitive capacities humans demonstrably share with chimps, indicate that, under circumstances in which a human being might experience emotional distress or trauma, chimpanzees respond similarly under comparable conditions. One example would be for a chimpanzee to be housed in isolation, with no physical or social contact with other chimpanzees, as well as with only minimal daily contact with caregivers. There is a reason that similar housing conditions in our nation's prisons, that is, solitary confinement, are considered to be the worst conditions for inmates to endure. (Indeed, solitary confinement of human prisoners is considered by some to be "cruel and unusual punishment.")

These findings suggest that the range and nature of invasive research in the United States represents unethical and, indeed, immoral actions. In its 1997 report, the National Research Council that examined the status of chimpanzees in research facilities in the United States noted the ethical and

moral responsibilities to chimps (National Research Council 1997). Unlike humans who participate in biomedical research, chimpanzees are incapable of giving informed consent. Therefore, it is clearly time for society to reappraise the status of humankind's closest primate relative.

Public Opinion: Driving Change

Increasing public concern has largely driven international efforts to end the use of chimpanzees in research. According to a recent opinion poll conducted by Zogby International for the Doris Day Animal League in 2001 (in Conlee 2003), 90 percent of Americans believe it is unacceptable to confine chimpanzees in government-approved cages (Figure 2), 54 percent believe it is unacceptable for chimpanzees to "undergo research which causes them to suffer for human benefit," and 65 percent say it is unacceptable to kill them for research.

A 2002 opinion poll by Penn, Schoen, and Berland Associates for The Humane Society of the United States (HSUS n.d.) found that 79 percent of the U.S. public supports creation of a government-sponsored sanctuary system to provide lifetime care to chimpanzees no longer used in research. This and other survey findings indicate that not only does the public oppose the suffering of chimpanzees in research, but it also is willing to financially support a significant commitment to chimpanzees, who can live to be sixty years old in captivity.

The National Science Board, which conducts surveys of public attitudes toward scientific research every three years, included the following statement in its 1985 survey: "Scientists should be allowed to do research that causes pain and injury to animals like dogs and chimpanzees if it produces new information about hu-

man health problems." In 2002 (the most recent survey results available as of 2005), 52 percent of adults opposed or strongly opposed this statement. When the same statement was used in a 1985 survey, only 30 percent of adults voiced opposition (National Science Board 2002) (Table 3).

U.S. Overview

Recent Issues

Over the last twenty years, major changes in the use of chimpanzees in research have taken place. The rush to increase breeding for HIV research in the 1980s was followed by a significant decrease in the number of facilities housing chimpanzees as well as in the number of chimpanzees at each facility in subsequent years. Three large chimpanzee research laboratories have closed since 1995, and many of their chimpanzees are now permanently retired at sanctuaries throughout the United States. In 1995 New York University decided to close its Laboratory of Experimental Medicine and Surgery in Primates (LEMSIP). Approximately half of the LEMSIP chimpanzees were sent to various retirement facilities, but the other half were sent to the Coulston Foundation, Alamogordo, New Mexico, the largest chimpanzee colony in the world at that time, which had a poor record of compliance with the Animal Welfare Act (AWA).

The second large closure was that of the chimpanzee colony at the Holloman Air Force base, also in New Mexico, in 1997. This colony of 141 chimpanzees who were used by the space program was released from the Air Force. In a controversial decision, all but thirty chimpanzees were sent to the Coulston Foundation instead of to sanctuaries that had volunteered to take in a number of them. (Those requests had been denied by the Air Force.) One of those sanctuaries was the Center for Captive Chimpanzee

Table 3 Public Opinion on Using Chimpanzees and Dogs in Painful and Injurious Research

Survey Statement: Scientists should be allowed to do research that causes pain and injury to animals like dogs and chimpanzees if it produces new information.

Year	Supporting/Strongly Supporting Animal Research	Opposing/Strongly Opposing Animal Research
1985	63	30
1988	53	42
1990	50	44
1992	53	42
1995	50	46
1997	46	51
1999	50	47
2001	44	52

Source: National Science Board 1985–2001.
Number of adults surveyed varied per year and ranged from 904 to 2,041.

Care (the CCCC—now known as Save the Chimps), an organization that ultimately sued to obtain custody of twenty-one of the chimpanzees. The CCCC entered into an agreement with the Coulston Foundation in October 1999 that brought those chimpanzees to live at the Save the Chimps’ sanctuary in Florida.

The most recent laboratory closing was that of the Coulston Foundation in 2002. Approximately one year before closing, Coulston transferred three hundred chimpanzees to the Alamogordo Primate Facility, currently run under contract by Charles River Laboratories, to settle violations of the AWA. The chimpanzees at the Alamogordo Primate Facility were not being used for research at that facility as of mid-2005, but they could be transferred elsewhere for research (Brent 2004). In 2001 the National Institutes of Health stopped funding the Coulston Foundation (Brent 2004).

By 2002 the company had collapsed financially and divested itself of 266 chimpanzees, selling them to Save the Chimps, which purchased the land and facilities from the company.

Despite the decrease in the number of chimpanzee laboratories and the retirement of a significant number of chimpanzees, there are signs that some aspects of chimpanzee research have been growing. In addition to 75 percent of private-sector growth at the New Iberia Research Center coming from requests for use of chimpanzees in research, New Iberia and the Southwest National Primate Research Center have each received funds from the National Institutes of Health to expand their chimpanzee-holding facilities. The abstract of the grant for New Iberia specifies that such a facility will allow other laboratories to hold their chimpanzees within the biomedical research community with-

out retiring them under the CHIMP Act (see below). This is an unfortunate development.

U.S. CHIMP Act

The large chimpanzee breeding effort launched in the United States in 1986 exceeded expectations at the same time it was determined that the chimpanzee was not a critical model for HIV research after all. This created a “surplus” of chimpanzees for research. As a result, the National Institutes of Health called on the National Research Council (NRC) to provide input on key issues, including the number of chimpanzees required to support research needs and how to address the long-term needs of the animals who had been produced. The NRC found (1) that euthanasia is not considered by the public to be an acceptable means of addressing the surplus issue (as previously noted); (2) a five-year breeding moratorium should be adopted; and (3) sanctuaries should be established for the long-term care of retired chimpanzees (National Research Council 1997).

Following the NRC report, lobbying efforts began for the creation of a national chimpanzee sanctuary system through what became known as the Chimpanzee Health Improvement, Maintenance and Protection Act (CHIMP Act). The animal protection coalition devoted to passage of the CHIMP Act was known as the National Chimpanzee Research Retirement Task Force (NCRRTF). It consisted of The HSUS, the American Anti-Vivisection Society, the American Society for the Prevention of Cruelty to Animals, the Society for Animal Protective Legislation, and the National Anti-Vivisection Society, with the support of an advisory board of numerous primatologists. The CHIMP Act was sponsored and introduced in the House of Representatives (H.R. 3514) by Rep. James Greenwood (R-PA) on

November 22, 1999; a companion bill, sponsored by Sens. Richard Durbin (D-IL) and Bob Smith (R-NH), was introduced in the Senate (S. 2725) on June 13, 2000. A legislative hearing was held on May 18, 2000, with key individuals testifying, including Jane Goodall of the Jane Goodall Institute. (John Strandberg of the National Center for Research Resources, National Institutes of Health [NIH], provided the only oral testimony against the bill).

The CHIMP Act incited a fair amount of controversy when then-House Commerce Committee Chairman Thomas Bliley (R-VA) proposed amendments that would have provided the research community with limited access to chimpanzees after they were sent into the sanctuary system. When this amendment was proposed, the animal protection community, including NCRRTF, became divided, and its support for the legislation declined. Some groups decided to continue work on the legislation to ensure that any opportunity to remove chimpanzees from the sanctuary system was as narrow and difficult as possible, fearing that the bill ultimately would allow the research community to have easy access to chimpanzees

while holding them in less expensive housing in the interim.

The final legislative language specified that various requirements be met before any individual chimpanzee could be removed from the system, thereby greatly reducing the chances that animals would be moved back into the laboratory. These requirements included:

- Researchers could subject the chimpanzee and his or her social group to only minimal pain, distress, and disturbance (as determined by the board of directors of the sanctuary).
- Special circumstances related to the particular chimpanzee's medical history might make him or her uniquely needed for research.
- The technology to be used was not available when the chimpanzee entered the sanctuary system.
- The research is essential to address an important public health need, and that the applicant has not violated the AWA.
- The proposal is subject to public scrutiny through a sixty-day formal notice and comment process.

The CHIMP Act (P.L. 106-551) was signed into law on December

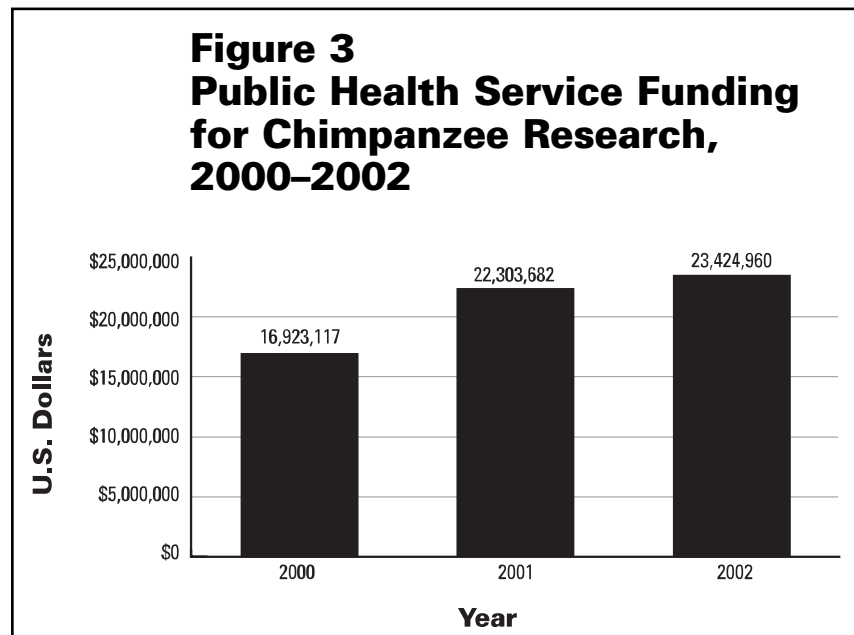
20, 2000, by President Bill Clinton. Some pro-animal groups pursued a repeal of the CHIMP Act, but they were unsuccessful. One important and positive result of the CHIMP Act was a shift in thinking and policy related to the use of chimpanzees in research.

Since passage of the legislation, various efforts have been underway to create the national sanctuary system. The NIH published a "sources sought" notice in 2001 (*Federal Register*; April 19, 2001) and, on September 30, 2002, granted the nonprofit Chimp Haven, in Shreveport, Louisiana, the contract to run the entire system. Chimp Haven's mission is to provide lifetime care to chimpanzees previously used in research, as pets, or for entertainment (Brent 2004).

The sanctuary contract stipulates that the federal government will provide \$19 million for the care of an initial two hundred chimpanzees for ten years, with Chimp Haven providing matching funds of \$4 million (Brent 2004). The government will also provide \$10 million in construction costs, and Chimp Haven is expected to match 10 percent of those funds (Brent 2004).

The Chimp Haven facility in Shreveport will house two hundred chimpanzees at the outset and eventually expand to house a total of three hundred. At least two other sites will hold groups of seventy-five or more. Chimp Haven can also contract care out to other facilities, but it will ultimately be responsible for all of the chimpanzees in the system—a maximum of nine hundred individuals (Brent 2004). The first phase of construction at Chimp Haven has been completed, and chimpanzees began to arrive on April 1, 2005 (personal communication, Chimp Haven representative, with S.B., April 22, 2005).

The U.S. government has asked laboratories and government entities holding chimpanzees to prepare lists of animals no longer



needed for research. These lists will be shared among the facilities so that laboratories can share and undertake research on chimpanzees if desired, but the lists had not been made available to the public as of mid-2005. Table 4 provides a timeline of events related to the creation of the national sanctuary system.

International Activities

Some countries already prohibit or strongly restrict the use of chimpanzees in research. In 1997 the United Kingdom announced that licenses to conduct research on great apes would no longer be granted, although great apes have not been used in research in the

United Kingdom since 1986 (U.K. Animal Procedures Committee 1998, 2001).

In 2000 New Zealand placed stringent restrictions on the use of non-human hominids (nonhuman great apes—which include chimpanzees, bonobos, gorillas, and orangutans) within its Animal Welfare Act (www.maf.govt.nz/biosecurity/legislation/animal-welfare-act/)

Table 4
National Chimpanzee Sanctuary System:
Timeline of Events

Date	Action
April 15, 1999	A coalition that includes representatives from the research, animal-protection, zoo, and sanctuary communities writes a letter regarding the issue of chimpanzee “retirement” and submits it to U.S. Rep. J.E. Porter (R-IL) and U.S. Sen. A. Specter (R-PA).
November 22, 1999	H.R. 3514, the Chimpanzee Health Improvement, Maintenance, and Protection (CHIMP) Act, is introduced in the U.S. House of Representatives by Rep. J. Greenwood (R-PA). This bill will require the federal government to provide for permanent “retirement” of chimpanzees who are identified as no longer needed for research.
May 18, 2000	The House Committee on Commerce holds a hearing on H.R. 3514. Those presenting testimony include J. Goodall (Jane Goodall Institute), J. Strandberg (NIH), T. Nelson (National Chimpanzee Research Retirement Task Force), and A. Prince (New York Blood Center).
June 14, 2000	S. 2725, the Chimpanzee Health Improvement Maintenance and Protection (CHIMP) Act, is introduced in the U.S. Senate by Sens. R. Smith (R-NH) and R. Durbin (D-IL).
September 20, 2000	S. 2725 gains approval by the Senate Health, Education, Labor, and Pensions Committee.
October 24, 2000	The House passes H.R. 3514 with the Bliley amendments (see section, entitled <i>Legislation: United States and International</i>).
December 6, 2000	The Senate passes S. 2725 unanimously.
December 20, 2000	President Clinton signs the CHIMP Act into public law (P.L. 106–551).
April 16, 2001	The National Center for Research Resources (NCRR), part of NIH, publishes a “sources sought” notice to determine whether there is an existing nonprofit that fulfills the requirements of the CHIMP Act and is interested in serving as the “contractor” of the sanctuary system.
September 28, 2001	NIH publishes a Request for Proposal for an entity to operate and maintain a sanctuary system via the CHIMP Act.
December 20, 2001	The departments of Labor, Education, Health and Human Services and related agencies’ 2002 Appropriations Act (H.R. 3061) allocates \$5 million to begin construction of the national chimpanzee sanctuary facilities.
January 10, 2002	President G.W. Bush signs H.R. 3061 into public law, including \$5 million toward construction of the national sanctuary system.
September 30, 2002	NIH announces the award of a contract to Chimp Haven to establish and operate a chimpanzee sanctuary, pursuant to the CHIMP Act.
May 1, 2003	Chimp Haven, the contractor of the national chimpanzee sanctuary system, breaks ground on its Shreveport, La., facility.
January 11, 2005	NIH publishes a notice of proposed rule making regarding standards of care for chimpanzees held in the national chimpanzee sanctuary system.

guide/awguide.pdf, 24). The country's director-general can approve the use of nonhuman hominids, but he or she must first consult the National Animal Ethics Advisory Committee; the use of these species must be in the best interest of the individual animal or the species; and the benefit must outweigh the harm. At the time this ban was implemented, no great apes were being used in research, but the action sent a strong message about the ethics of such use.

When the Netherlands finalized an amendment to the Dutch Law on Animal Experiments in 2002 that prohibits the use of great apes in biomedical experiments (Conlee, Hoffeld, and Stephens 2004), six chimpanzees being used in hepatitis research already underway were exempted from the ban. At the time of the amendment, the only chimpanzees in the European Union were located at the Biomedical Primate Research Centre (BPRC) in the Netherlands. In October 2002 the Dutch minister of education and the director of the BPRC signed an agreement for the transfer of ownership of fifty-nine chimpanzees to the AAP Sanctuary for Primates and other Exotic Animals (Anonymous 2003). AAP suffered various delays but had secured a site for the sanctuary and expected construction to begin in mid-2005 (AAP Sanctuary for Exotic Animals 2005).

In June 2003 Sweden's National Board for Laboratory Animals established new regulations that ban the use of apes (great apes and gibbons) in research (Anonymous 2003). The only exception is for the conduct of noninvasive behavioral studies. As was the case in New Zealand, great apes were not being used in research in Sweden when these regulations were being implemented, but the rules would prohibit any such use in the future.

Japan has also taken steps by banning invasive research on great apes (Goodman and Check

**Table 5
International Legislation, Policies,
and Regulations Related to
Chimpanzees in Research**

Country	Type of Action	Year Enacted	Comments
United Kingdom	Policy	1997*	Licenses to conduct research on nonhuman great apes will no longer be granted
New Zealand	Legislation	2000	Stringent restrictions on the use of nonhuman great apes in research
United States	Legislation (P.L. 106-551)	2000	Chimpanzees determined no longer needed in research are transferred to a national sanctuary system
Netherlands	Legislation: an amendment to the Dutch Law on Animal Experiments	2002	The use of great apes in biomedical experiments is prohibited
Sweden	Regulations	2003	The use of apes in research is prohibited
Japan	Unknown	Unknown	Invasive research on great apes is prohibited (Goodman and Check 2002)

*Although the United Kingdom has had its policy in place since 1997, great apes have not been used in research in that country since 1986.

2002), but it appears that noninvasive research is still allowed. Table 5 provides a summary of international legislation, regulations, and policies.

The Future of Chimpanzee Research

Trends in international legislation strongly suggest that additional countries will adopt legislation to restrict or end the use of chimpanzees (and other apes) in biomedical research and testing. The U.S. CHIMP Act of 2000 acknowledged the special status of chimpanzees and human responsibility for their lifetime care. There are current efforts, including by The

HSUS, to end invasive research on chimpanzees in the United States in the coming years.

Regardless of legislative efforts, the drastic decline in chimpanzee research in the United States over the past twenty years is the result of various factors, including the high cost of keeping chimpanzees in laboratories, public pressure, and evidence of the physical and psychological similarities between chimpanzees and humans. Trends suggest that the use of chimpanzees in research in the United States will continue to decline. Additional efforts to protect chimpanzees, such as legislation to prevent private ownership of chimpanzees, legal work to gain personhood for chimpanzees, and inclusion of chimpanzees and

humans in the same genus, are likely continue or expand. In the meantime, the likelihood of primatologists providing even more evidence of the intelligence and emotional capabilities of chimpanzees will further support the argument that their use in biomedical research and testing should come to an end.

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Note

¹ Other apes, including gorillas, orangutans, and gibbons, were used in the research laboratory at one time, but chimps successfully breed in captivity and as adults are smaller and easier to handle than either gorillas or orangutans.

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About the Contributors

Sarah Boysen received her Ph.D. in 1984 from The Ohio State University. Her current research interests are animal cognition, particularly the acquisition of counting abilities and numerical competence in non-human primates; cognitive development in the great apes, including attribution, self-recognition, and intentional behavior; and social behavior and tool use in captive lowland gorillas. She is currently consulting editor for the *Journal of Comparative Psychology*.

Kathleen Conlee is director of program management, Animal Research Issues, at The HSUS and is responsible for the organization's work related to nonhuman primates in research, the use of animals in education, and the HSUS Pain and Distress campaign. She previously worked for seven years at a large nonhuman primate breeding facility and a year and a half at a chimpanzee and orangutan sanctuary.

Jennifer M. Felt graduated from the University of Vermont in 1999 and served for two and a half years in the Peace Corps in Honduras. She was program manager for Latin America and the Caribbean for Humane Society International (HSI), the international arm of The HSUS, until June 2004, when she became deputy director for trade capacity building at The HSUS.

Stephanie Edwards is a 2003 graduate of the University of Maryland and program assistant and Web content manager for HSI.

Katherine C. (Kasey) Grier is associate professor in the Department of History, University of South Carolina. She is the author of *Culture and Comfort: Parlor Making and Middle Class Identity* and the forthcoming *Pets in America: A History*. Her current research focuses on the history of animal-human interaction. She serves as guest curator for an exhibition on the history of pet keeping in the United States originating at McKissick Museum, the University of South Carolina, in 2005 and traveling for three years thereafter.

Kristin Kaschner received her M.Sc. from Albert-Ludwigs-Universität of Freiburg, Germany, in 1997. Based at the Underwater Acoustics Group at Loughborough University, Leicestershire, England, she developed an acoustic analysis technique to study the behavior of small cetaceans around midwater trawl nets. She joined the Marine Mammal Research Unit at the Fisheries Centre at the University of British Columbia (UBC) in 1998 and has been a member of the Sea Around Us Project, based at UBC and devoted to studying the impact of fisheries on the world's marine ecosystems, since 1999. Ms. Kaschner was an invited participant at the International Whaling Commission Scientific Committee workshop on bycatch mitigation and acoustic deterrents in 1999 and is a member of the Cetacean Bycatch Task Force. She has been a FishBase collaborator since 2000, compiling information about the acoustical behavior of fish.

Randall Lockwood received his Ph.D. from Washington University in St. Louis. He is senior vice president for anti-cruelty initiatives and training for the American Society for the Prevention of Cruelty to Animals and former vice president/Research and Educational Outreach for The HSUS. He is the co-editor of *Cruelty to Animals and Interpersonal Violence* and co-author (with Frank Ascione) of "Cruelty to Animals: Changing Psychological, Social, and Legislative Perspectives," which appeared in *The State of the Animals: 2001*.

Kelly O'Meara is program manager, Africa and Asia, for HSI. She has promoted humane slaughter practices to government representatives in Indonesia and Vietnam; initiated and organized first-of-their-kind workshops on stray dog/street animal control in Moscow and St. Petersburg; and managed a two-year street dog control program on the island of Abaco in the Bahamas. A graduate of the University of Massachusetts, she holds certificates from the Royal Society for the Prevention of Cruelty to Animals (RSPCA) in large-animal euthanasia and from Bristol University, England, for animal welfare officer training. She is co-author of the HSI report *Dogs on Abaco Island, the Bahamas: A Case Study*.

Daniel Pauly acquired his doctorate in fisheries biology in 1979 from the University of Kiel in Germany. He is a former division director of the International Center for Living Aquatic Resources Management (ICLARM) in Manila and taught fisheries sciences at the University of the Philippines. In 1994 he joined the Fisheries Centre, University of British Columbia, while remaining ICLARM's principal science advisor until 1997 and the science advisor of its FishBase project until 2000. Since 1999 he has been principal investigator for the Sea Around Us Project. In 2001 he received the Murray Newman Award for Excellence in Marine Conservation Research and the Oscar E. Sette Award of the Marine Fisheries Section, American Fisheries Society. He was named an honorary professor at Kiel University in 2002 and elected a Fellow of the Royal Society of Canada (Academy of Science) in 2003.

Nancy Peterson, a registered veterinary technician, is an issues specialist in the Companion Animals section of The HSUS and coordinator of the Pets for Life Training Centers. Before joining The HSUS, Ms. Peterson worked in small-animal veterinary hospitals and as a trainer of dogs for people with disabilities. Her articles promoting pet-friendly rental housing have been published in numerous housing magazines. She was a member of the HSUS staff who collaborated on *The Humane Society of the United States Complete Guide to Cat Care* (co-authored with Wendy Christensen).

J.F. Reece received his B.Sc.(Hons.) in biology from University of York and was qualified (B.V.Sc.) from Liverpool University Veterinary School in 1994. He worked for more than three years in rural, large-animal veterinary practice in Devon, England. Since 1998 he has been associated with the work of Help in Suffering, an animal welfare charity in Jaipur, India, as a volunteer veterinary surgeon. Since 2002 he has been in charge of the ongoing ABC Extension Project, sponsored by HSI, at Help in Suffering Jaipur.

Beth Rosen has worked in the HSUS Government Affairs and Evaluation and Planning departments since 2001. She received her master's degree in public administration from New York University.

Andrew N. Rowan is executive vice president, operations, for The HSUS. He is the author of *Of Mice, Models, and Men*; co-author of *The Animal Research Controversy: Protest, Process, and Public Policy*; and coeditor of Humane Society Press's State of the Animals series.

Stephanie Shain is director of companion animal outreach for The HSUS and one of the organization's leading spokespeople on pet-related topics. From 1995 to 2000 she worked as assistant director of programs for the American Anti-Vivisection Society.

Margaret R. Slater is a veterinarian and associate professor of epidemiology in the departments of Veterinary Anatomy and Public Health and Small Animal Medicine and Surgery in the College of Veterinary Medicine at Texas A&M University in College Station, Texas. The author of *Community Approaches to Feral Cats: Problems, Alternatives, and Recommendations*, she is frequently invited to speak on feral cat issues at professional conferences nationwide.

Neil Trent is executive director of HSI. A graduate of the law enforcement division of the RSPCA, he worked in a number of capacities for the RSPCA in England, the Bahamas, and Australia. He is a former field officer and field services director for the World Society for the Protection of Animals. He is co-author of "The State of Meat Production in Developing Countries: 2002," which appeared in *The State of the Animals II: 2003*.