A Review of Autopsy Reports on Chimpanzees In or From US Laboratories

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Summary — Approximately 1000 chimpanzees are currently held in five federally owned, or supported, US laboratories. This study reviews 110 autopsy reports on chimpanzees who died from 2001–2011 in laboratories or in sanctuaries (but who were from laboratories), in order to glean information about their premorbid health and causes of death. The findings raise questions about the health status of the chimpanzees remaining in laboratories. Most of the chimpanzees currently held are not involved in active protocols. The *Chimpanzee Health Improvement, Maintenance, and Protection (CHIMP) Act 2000* states that chimpanzees "not needed" for research "shall" be accepted into the federal sanctuary system, but criteria for when a chimpanzee is deemed "not needed" are not given. The assessment of "not needed" lies with the Secretary of Health and Human Services, who has left the decision to the discretion of the laboratories. This autopsy review revealed that the majority of the chimpanzees who died in laboratories had been suffering from significant chronic or incurable illnesses, and most often had multi-system diseases that should have made them ineligible for future research, on scientific, as well as ethical, grounds. The study's findings are significant in establishing the need for defined criteria for chimpanzee retirement to sanctuary.

Key words: *autopsy review, CHIMP Act, chimpanzee, chimpanzee retirement, multi-system diseases,* Pan troglodytes*, US Department of Health and Human Services.*

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Introduction

Chimpanzees have been used in US biomedical, air and space, and behavioural research since the early 1930s. As of May 2012, approximately 1000 chimpanzees are held in US laboratories. An estimated 80–90% of these individuals are not in active research protocols (1; unpublished communication, J. VandeBerg. Workshop communication at the XXII International Primatological Society Congress, Edinburg, UK, 2008), as chimpanzee use has been steadily declining over the last 10–20 years. Chimpanzee use in hepatitis C research has declined by 50–60% over the past 30 years, and is at an historic low, while non-animal hepatitis C research has increased 80-fold over the same period (2). AIDS-related chimpanzee studies fell by nearly 90%, from the year 1998 to 2005 (3). However, a decrease in the numbers housed and maintained in laboratories has not matched this trajectory. Since 2000, under the *Chimpanzee Health Improvement, Maintenance, and Protection (CHIMP) Act*, a chimpanzee can be euthanised only when it is "in the best interests of the chimpanzee involved, as determined by the system and an attending veterinarian" (42 U.S.C. §283m).

There is a "prohibition" against the euthanisation of a chimpanzee solely because she/he is no longer considered to be needed for research. Instead she/he shall be retired. While the CHIMP Act requires the US Secretary of Health and Human Services (HHS) to determine which chimpanzees are not needed and should be retired, the assessment of whether or not an individual chimpanzee is still 'needed' for research has been left up to the laboratory housing that chimpanzee. Only 20% of the total of 590 chimpanzees (August 2011 calculation) living in all US sanctuaries and one Canadian sanctuary (home to chimpanzees from US research), were retired to federal sanctuary under the CHIMP Act (K. Allen, personal communication: "Of 161 chimpanzees retired to Chimp Haven under the CHIMP Act, 119 were alive as of 6 January 2012"; see Appendix 1). Most of the others were rescued from private laboratories.

Currently, there is widespread ethical, legislative, and scientific debate regarding the continuing use, housing, and maintenance of chimpanzees in US laboratories — and ten other scientifically advanced nations, as well as the EU, have ended, banned, or severely limited the use of chimpanzees. Based on anecdotal evidence from autopsies performed at sanctuaries caring for chimpanzees rescued, or retired, from US research facilities, chimpanzees

used for decades in invasive research have been left with physical, as well as psychological, disabilities, and often have organ damage, massive adhesions, and multiple other diseases. If these findings could be scientifically verified, then keeping chimpanzees who are diagnosed with multiple organ disease, terminal disease, or chronic stress and its accompanying physical and behavioral manifestations, in laboratories for current or future research use, would be contraindicated for both scientific and ethical reasons, since sick and chronically stressed chimpanzees are inherently poor research models. Routine laboratory procedures have been shown to cause animals to have statistically significant elevated physiological stress indicators, such as heart rate, blood pressure and hormones, including cortisol (4, 5), which could compromise the study's validity (6). Studies on human post-traumatic stress disorder (PTSD) have shown acute stress to affect glucose metabolism and components of the immune system (7), as well as genetic pathways associated with the immune system (8, 9), all of which could confound studies on infectious and other diseases. Although these variables are often not reported (10), scientists caution against disregarding such effects (11–13).

This review of autopsy reports confirms that the vast majority of the chimpanzees suffered from multi-organ physical disease. However, the chimpanzees who died in the laboratories, rather than having been retired, were either being used in research or, presumably, being held for future use. Housing and maintaining chimpanzees, even in the absence of active protocol use, carries a fiscal benefit to the housing institutions. The National Institutes of Health (NIH) awards laboratories up to $67 *per diem* per chimpanzee and, on average, $40 *per diem* to five facilities currently housing, maintaining or using chimpanzees. Between 39% and 71% (on average 51%) of the total grant awarded is allowed for "indirect costs" — expenses which do not need to be used for either direct chimpanzee research or care (14).

In order to determine the physiological state of the chimpanzees who died in the last 10 years and were either in, or from, US laboratories, a group of three independent board-certified pathologists (Appendix 2) were asked to review and summarise the chimpanzee autopsy reports, which had been performed by the resident, or external, veterinarians/pathologists at the request of the laboratories or sanctuaries. While this autopsy review could not, nor was an attempt to, ascertain a cause– effect relationship between chimpanzee illnesses/ deaths and their research use history or the effects on them of the conditions of their laboratory confinement or use, the review was able to document causes of death and premorbid health status as identified in their autopsy reports. The reviewing pathologists all agreed that, despite often incomplete or missing medical histories, no available research histories, the inferior quality of many of the autopsies, and the often incomplete nature of the written reports, the data did reveal the physical condition of the chimpanzees at the time of death, and raised the question, given their state of health, as to whether some, many, or most of those who died in laboratories should have been deemed eligible for retirement and offered months, or years, in a sanctuary before their deaths.

Based on the autopsy reports, the pathologists all agreed that the majority (at least 64%) of the chimpanzees being held at the laboratories, presumably for current or future research, had been chronically sick. Questions about the decisions to hold them, despite their physical and psychological conditions, are given added weight by the recent NIH-directed Institute of Medicine (IOM) report (1) that most current biomedical research use of chimpanzees is not necessary — a conclusion which has contributed to NIH's formation of a specific Council of Councils to address population needs. In an official Request for Information from the NIH (15), following the IOM's recommendations, the NIH asked for input on, "Factors to consider when advising on the size and placement of active and inactive populations of NIH-owned or -supported chimpanzees as a result of implementing the IOM recommendations…". The results of this review make a strong case for the need for NIH to spell out specific and consistent criteria by which retirement must be determined.

Methods

In July 2011, US laboratories that house government owned or supported chimpanzees for research were sent *Freedom of Information Act* (FOIA) or state open records requests for autopsy reports on all government owned and/or supported chimpanzees who had died at their facilities from 2001 to 2011. An autopsy is a thorough *post mortem* examination of a corpse, which is carried out to determine the cause of death and the presence of other diseases or injuries. The term is interchangeable with necropsy, which is commonly used when referring to a non-human animal. The word autopsy is being used here to emphasise the commonality between human and chimpanzee great apes — this commonality being one of the reasons why both veterinary and human pathologists were involved. The facilities that received requests included:

a) Alamogordo Primate Facility (APF), Alamogordo, NM, USA. The APF is a holding facility for chimpanzees for research, and most, if not all, have history of prior research use. No research occurs at the facility. Instead, chimpanzees are sent to requesting laboratories. Once 'leased' in this way, the chimpanzee cannot return to APF.

b) MD Anderson Cancer Center (MD Anderson), Houston, TX, USA.

c) New Iberia Research Center (NIRC), New Iberia, LA, USA.

d) Southwest National Primate Research Center (Southwest), San Antonio, TX, USA.

e) Yerkes National Primate Research Center, Atlanta, GA, USA. Yerkes was sent a state open records request for autopsy reports on only their privately owned chimpanzees; they do not house any government owned chimpanzees.

f) US Food and Drug Administration (FDA), Rockville, MD, USA.

g) Centers for Disease Control and Prevention (CDC), Atlanta, GA, USA.

The federal facilities (APF, CDC and FDA) received federal FOIA requests. The private laboratories (MD Anderson, NIRC, Southwest and Yerkes) were sent state open records requests, because, as private facilities, they are not subject to the FOIA. While not bound by state open records requests either, US facilities can, and sometimes do, voluntarily respond when such a request is made.

Eight sanctuaries with chimpanzees from research (seven private sanctuaries and one US government-supported sanctuary) were asked to supply autopsy reports on their chimpanzees with research histories. The private sanctuaries (six in the US, and one in Canada with chimpanzees from a US laboratory) comprised:

a) Save the Chimps (STC), Fort Pierce, FL, USA.

b) Chimpanzee Sanctuary Northwest (CSNW), Cle Elum, WA, USA.

c) Wildlife Waystation (WW), Sylmar, CA, USA.

d) Primarily Primates Inc. (PPI), San Antonio, TX, USA.

e) Cleveland Amory Black Beauty Ranch (Black Beauty), Murchison, TX, USA.

f) Chimpanzee and Human Communication Institute (CHCI), Ellensburg, WA, USA.

g) Fauna Foundation (Fauna), Chambly, Quebec, Canada.

For Chimp Haven (CH), the federally supported sanctuary in LA, USA, a request for autopsy reports was sent to the sanctuary and to the NIH, the federal agency that provides support for CH. We were directed by the sanctuary to submit an SCCC Protocol for the Study of Live Vertebrates application for review by their board, and we complied with this request accordingly.

In response to our requests (Tables 1 and 2), we received 110 autopsy reports from three laboratories and two sanctuaries (70 from the APF, 23 from the NIRC, one from the FDA, 12 from the STC, and four from Fauna). The remaining three laboratories and six sanctuaries either did not respond, denied our request, or reported no autopsy records for that time frame. The CDC stated that their records "failed to reveal any documents pertaining to [our] request". MD Anderson denied our request, claiming that "the requested information is [exempted] from disclosure." Southwest and Yerkes did not respond to our request. Of the eight sanctuaries, STC and Fauna provided their autopsies, WW and CSNW had no autopsies for that time frame, PPI and CH denied our request, and CHCI and Black Beauty did not respond.

Once the autopsy reports had been received, a master list of the original files was created, and copies of the files were made with all identifying information regarding the laboratory or sanctuary, personnel, pathology laboratory, or autopsy pathologists redacted. The files were numbered and reorganised by using a random number generator (http://stattrek.com/Tables/Random.aspx). The redacted and randomised reports were divided equally among the pathologists.

One veterinary pathologist and two human pathologists (Appendix 2) were enlisted, to serve as objective reviewers of 110 autopsy reports on chim-

Table 1: A breakdown of laboratory responses to requests for chimpanzee autopsy reports

Name of laboratory	Response
Alamogordo Primate Facility	Complied and sent 70 reports
MD Anderson Cancer Center	Denied request; claimed "the requested information is [exempted] from disclosure"
New Iberia Research Center	Complied and sent 23 reports (another 41 reports sent at a later date)
Southwest National Primate Research Center	Did not respond
Yerkes National Primate Research Center	Did not respond
Food and Drug Administration	Complied and sent one report
Centers for Disease Control and Prevention	Reported no reports available; claimed records "failed to reveal any documents pertaining to [our] request"

Table 2: A breakdown of sanctuary responses to requests for chimpanzee autopsy reports

Name of sanctuary	Response
Chimp Haven	Denied request
Chimpanzee and Human Communication Institute	Did not respond
Chimpanzee Sanctuary Northwest	Reported no reports available
Cleveland Amory Black Beauty Ranch	Did not respond
Fauna Foundation	Complied and sent four reports
Primarily Primates	Denied request
Save the Chimps	Complied and sent 12 reports
Wildlife Waystation	Reported no reports available

panzees (*Pan troglodytes*) who had been used in research, or confined for potential use. Each pathologist was offered a small honorarium for their services; two declined. Human, as well as veterinary, pathologists were enlisted to review the reports, because most of the veterinary pathologists contacted claimed inadequate knowledge of chimpanzee disease, or relevant human diseases. All the board-certified pathologists who agreed to participate felt that reviewing chimpanzee autopsy reports was within their scope of expertise, provided that they were not asked to ascertain any cause–effect relationship between the cause of death and the chimpanzees' research histories. Assured that such conclusions were outside the scope of the study, they agreed to meet the following request: to review chimpanzee autopsies previously performed by veterinarians/pathologists, to summarise the causes and categories of death, as well as any surrounding information relative to the length of such illnesses and the health of the chimpanzee at the time of death, and tabulate these data from the written autopsy reports made available to them. Each pathologist was asked to review their set of autopsy reports, and to provide a final report that included determination of chronic or acute illnesses, the duration of the illness, the cause of death (COD), indications of (or likelihood of) suffering and its sources, and any other observations or questions raised by the autopsies. The pathologists were asked to render their conclusions by using a common template and an individualised narrative. The authors of the report then compared the pathologists' conclusions and found negligible variations in the various categories and prevalences of the illness reported. Any unclear, disputed, or outlying data were omitted from the final counts.

Results

The autopsies received were dated from January 2001 to July 2011. The chimpanzees concerned were between 9.5 and 53 years old. Based on an age-related study of laboratory values reported by Videan, Fritz and Murphy (16), laboratory chimpanzees are considered elderly at 25 years, for males, and 30 years, for females. The average age of death of those whose ages were known was 29 years old; for 15%, no age had been given. The females ranged in age from 9.5 to 53, and the males from 14 to 51. The identified gender distribution was 49 females, 59 males, and two unidentified. The autopsy of one individual, identified as female, included a uterus, but noted: "Sections of testis, epididymis, and seminal vesicle were also included with tissues submitted for this animal; the origin of these tissues is unknown."

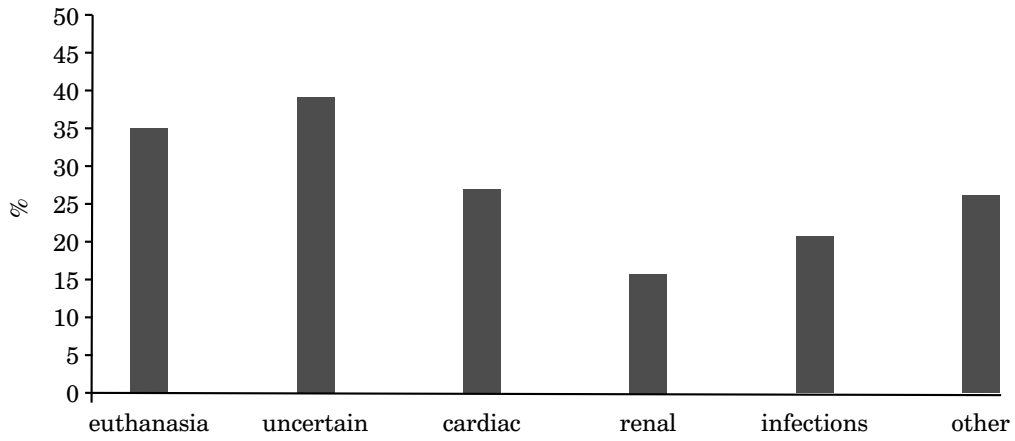
Quality of the autopsies

Of the resulting 110 autopsies, the reviewing pathologists considered a total of 46% to be "incomplete". For example, some reports lacked significant data, such as "sex designation, age, [or] weight". One autopsy "reported only histology" and no gross findings, whereas others "[were] comprised of only gross dissection data… [with]… no histopathology, toxicology, [or] microbiology". Some described only selected organs, omitting other possibly-important organs. In some cases, "tissues [were] described as autolysed [i.e. delayed or improper fixation likely]", and most reports lacked clinical history. Another report offered conflicting information regarding the date of death. The report described a 22-year old female chimpanzee as having been "diagnosed with systemic hypertension… on October 28, 2006… [and]... pronounced dead… on June 21, 2006" — four months prior to being diagnosed.

Detailed findings

As a result of the overall poor quality of the data relative to the standards required in most human

Figure 1: Cause, or one of the causes, of death



and veterinary settings, the autopsy review was constrained. Nonetheless, it was possible to reach certain conclusions. The autopsies revealed a range of both acute and chronic premorbid illnesses. They also indicated the presence of avoidable injuries and serious illnesses identified only *post mortem* (Figures 1–3).

A total of 38% of the chimpanzees had died suddenly. Others had died during treatment for a severe illness. In some cases, the reports did not include a clinical history that could help identify how the chimpanzee had died. A total of 35% of individuals had been euthanised for humane reasons. Equal numbers of females and males had been euthanised (19 individuals, 38% of the females and 32% of the males). Euthanasia represented 38% of the chimpanzee deaths at APF, 35% at NIRC, 25% at STC, and none at Fauna or FDA. In five out of 36 cases, the chimpanzees had suffered possibly preventable deaths, including a 21-year old female, who was euthanised for what was presumed to be a neoplasm, but turned out to have been a benign lesion. There were several iatrogenic deaths (those said to have been caused by medical treatments or interventions, such as anaesthesia). At APF, three chimpanzees had been accidently electrocuted, and two others died from reactions to anaesthesia after a routine blood draw and a dental extraction, respectively. In addition, the autopsy of one chimpanzee who had died after a routine blood draw, revealed she had a subdural haematoma (trauma-induced bleeding around the brain). This raises the question as to whether her death was a reaction to the anaesthesia, as reported, or was instead caused by a fall after being darted for the procedure.

Many of the autopsies (39%) did not define a precise cause of death. For those that did, the predominant cause in males was cardiac disease

Figure 2: Prevalence of disease or co-existing disease

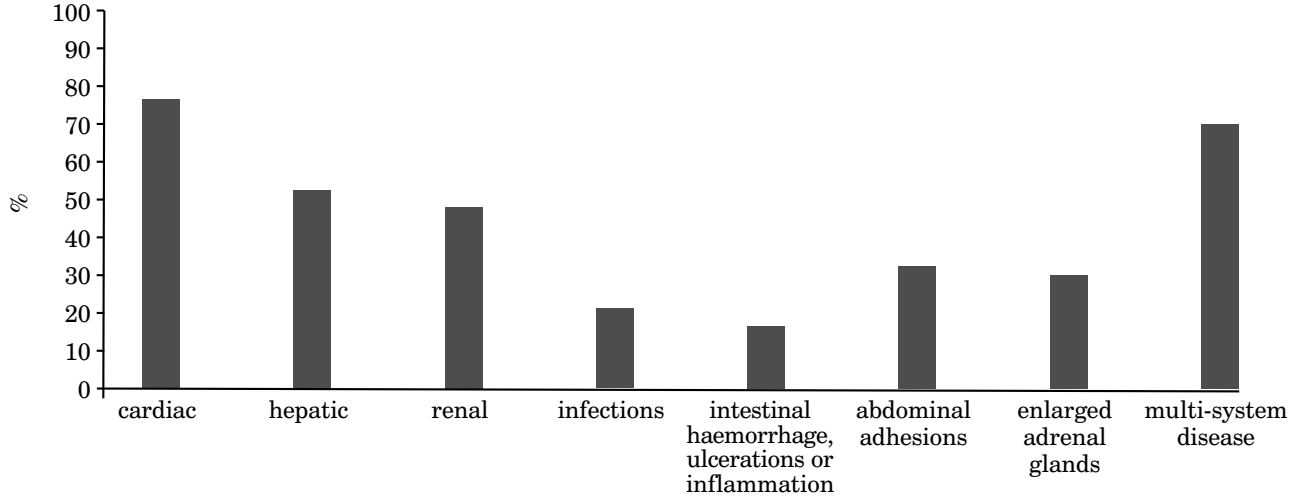
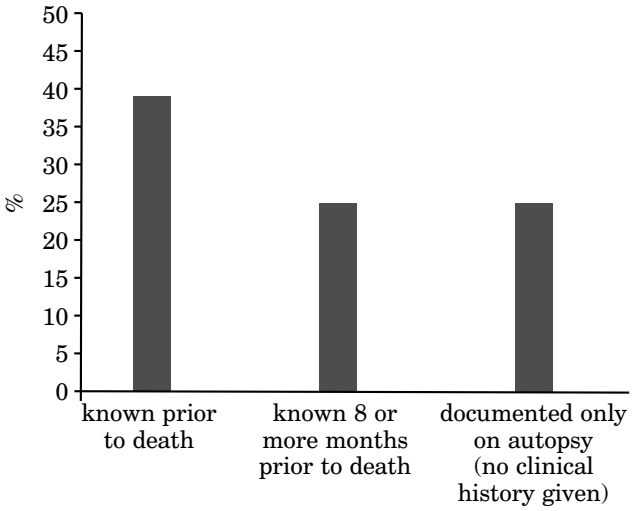


Figure 3: Duration of chronic disease



(41%), while in females it was renal failure (18%). Significant cardiac and renal disease was found in many other chimpanzees, in addition to those where it was the cause of death. The ages of the chimpanzees with heart disease ranged from 14 to 53 years, with an average age of 30 years. In total, 85 chimpanzees (77%) had significant cardiac disease, and 57% of those had cardiomyopathy, a disease of the heart muscle that can lead to hypertrophy, dilatation, fibrosis, arrhythmias and sudden death. In other cases, gross findings were suggestive of cardiomyopathy, but either no histological examination was performed to confirm it, or no specific diagnosis was given. Of those with cardiomyopathy, 39% were female (19 females of the total 49 cardiomyopathy cases) and 61% were male (30 males of the total 49 cardiomyopathy cases). This meant that 39% of all the females and 51% of all the males in the study had cardiomyopathy. Other causes, or one of the causes, of death, included renal pathology (16%), infections (21%), or other pathology (28%).

Of all the chimpanzees, 48% had significant renal disease at the time of death. Half of these were females and half were males. Their ages ranged from 13 to 50 years, with an average age of 30 years. There was significant liver disease in 53% of the animals — in 22% it was described as some form of hepatitis, and 24%, all male, were described as having fibrotic livers. There were significant infections, such as pneumonia, peritonitis or abscess, in 22% of the chimpanzees — approximately 8% had pneumonia (six females and three males). There were enlarged or "congested" adrenal glands in 31% of the chimpanzees (10 females and 24 males), and 33% had significant abdominal adhesions, most of which were present in males (7 females and 29 males). There were intestinal or gastric ulcerations and/or petichial haemorrhages in 16% of the chimpanzees, while six of them had tracheal haemorrhages.

Of the chimpanzees in the laboratories, 39% had been identified in the autopsy's clinical narrative as having been known to have had severe chronic illnesses (25% for eight months or more and, in some cases, for four or more years) prior to their death. On autopsy, a number of other chimpanzees (25%) were found to have chronic diseases which were likely to have been present for a significant length of time, but had not been recognised before death. In other cases, the records contained no clinical histories. It was therefore not possible to determine whether the illnesses had been recognised, or for how long they had been present. Overall, roughly 69% of all the chimpanzees had significant multiple organ disease (Figure 2).

Discussion

The quality of the autopsy reports makes it difficult to evaluate the full prevalence of diseases seen in the chimpanzees in, or from, laboratories. As a result, the frequencies of disease tabulated here reflect minimal incidences, which could, in fact, have been much greater, had the autopsy reports all complied with a standard autopsy protocol.

Nonetheless, from the autopsy reports deemed acceptable by the reviewing pathologists, this study was able to reveal that a majority of the chimpanzees suffered from chronic illnesses and, in most cases, from multi-organ disease. A major implication of the lack of a rigorous autopsy protocol, which would have included proper identifying information, clinical history, gross findings, and histology on all organs, is that the results of the study are very likely to under-represent the true incidences of the findings. All of the reported numbers and categories of illness/injury may well have been higher, while other pathologies, not noted, might in fact have been present, had all the autopsies been more comprehensive.

Further, it is not known whether all the chimpanzees who died during the study's requested 10-year time span had autopsies performed on them. Thus, the number of autopsies received may or may not reflect the actual number of deaths over the defined 10-year period. In addition, since some of the autopsies only examined certain organs, an assessment of the actual prevalence and severity of injury and disease was not possible. This was the case, for example, with the findings on adrenal gland enlargement. Most of the autopsies did not examine, or comment, on the adrenal glands, so the actual incidence of adrenal gland enlargement or other adrenal pathology is unknown and could have been greater than that stated. This particular

omission, for example, is noteworthy given that adrenal pathology could have, among other things, been an indication of chronic stress.

Whether or not the illnesses were a direct result of the procedures performed on the animals, or of infections given to them, cannot be determined, nor was that the focus of the study. However, the fact that the chimpanzees had been sick is irrefutable. The data cannot be extrapolated to know, with certainty, whether or not living chimpanzees currently in laboratories do or do not have similar illnesses. However, it is reasonable to assume that many do, since those who died were being used or held as potential research subjects, as are those currently in laboratories. Further, given the age range of both the population included in this review and those currently in laboratories, it is highly probable that both groups share similar histories of use and confinement. The chimpanzees included in this study, and who had died in sanctuary, were all rescued from laboratories that had closed and were not a population of those who had been voluntarily retired after being deemed "not needed". Hence, they also represent a population that was either being used in or held for research.

Chimpanzees often mask symptoms, but attentive caregivers and medical staff need to be able to detect subtle signs of progressive heart or kidney disease (e.g. lethargy, weight loss, loss of appetite, pallor, behavioural changes, weakness, or even enlarged scrotums). Attention to such symptoms could possibly have led to more-extensive premorbid examinations, with earlier diagnosis and treatment of acute illnesses, and recognition of significant chronic or life-threatening diseases. It was clear from the autopsy reports that, although many of those who died had been known to be seriously ill for quite some time, the illnesses of others had only become apparent after death. One reviewing pathologist commented that two chimpanzees who "had died from renal failure, allegedly had signs of illness for only a few days prior to death, leading me to suspect that either the observation of these animals was inadequate or [there was] inaccurate reporting of [the] disease observed". Additionally, some of the chimpanzees with sudden death from cardiomyopathy had had an acknowledged prior history of cardiac arrhythmia, which had not been considered significant enough to warrant retirement.

An additional finding in this review was the large number of chimpanzees with abdominal (and sometimes thoracic) adhesions. While some of the chimpanzee records revealed prior surgery, or surgeries, most gave no surgical history. Therefore, it is puzzling why so many developed these adhesions. One plausible theory is that the adhesions could have been caused by the repeated anaesthetic darting to which the chimpanzees were subjected. Only a small percentage of the chimpanzees have been 'trained' to sometimes accept a needle for anaesthesia. Most are darted for everything from routine examinations and blood tests to more-invasive procedures. Many are known to have undergone hundreds of dartings (17) over the course of their years in research. The dart needle is approximately 1–1.5 inches long, and is fired into the chimpanzee with a force of roughly 50psi. A darted chimpanzee falls onto cement, or steel-barred floors, sometimes from a high perch. In the presence of an anticipated darting, chimpanzees run and thrash about in attempts to avoid being hit. As a result, the laboratory records of chimpanzees in sanctuary document how they were often hit in all conceivable body parts — the scrotum, corner of the eye, lip, back, stomach, bottom of a foot — and typically needed to be hit multiple times in order to achieve a 'knockdown'. It is reasonable to assume (as documented by the sanctuaries) that chimpanzees sometimes, even often, get darted in the abdomen, and that the resultant introduction of bacteria or chemicals could cause local inflammation and the development of adhesions.

Several chimpanzees had died needlessly, including three who had been accidentally electrocuted in their cages, one who had been euthanised for a presumed malignancy that turned out to be benign, one who had died after aspiration during dental work, one who had died after anaesthesia for a routine blood draw, or possibly from a subdural haematoma resulting from the 'knockdown', and one who had died of a bowel obstruction from an ingested hose.

However, the major finding remains that an extremely large proportion of the chimpanzees in our study were known and recorded by the laboratory to have been severely chronically ill for more than eight months prior to their deaths and, in some cases, for more than four years. Some autopsy reports included phrases like: "on high-risk list due to advanced heart disease, systemic hypertension, and chronic renal failure"; "diagnosed with multiple chronic disease processes by veterinary staff, DNR [Do Not Resuscitate]"; "on high-risk list, DNR" or "at high risk for sudden cardiac death," for many months or even years before the chimpanzee died. Yet those chimpanzees had been kept in the laboratory, presumably for possible future research use.

This review raises significant concerns about other chimpanzees currently held in US laboratories, who, because of their probable failing health, should be deemed no longer suitable for research and retired. Both scientifically and ethically, the chimpanzees in this review who died in laboratories after acute, chronic, and missed or undiagnosed terminal or debilitating illness, were inappropriate research models. Given the distribution of ages, the percentages of males and

females, and the inclusion of chimpanzees from several different laboratories (even those in sanctuary represented multi-laboratory rescues), this review suggests that the health and well-being of other chimpanzees now in laboratories would be a similar matter of concern and must be ascertained.

A substantial number of chimpanzees had been described as having been well, but, on autopsy, had been shown to have had severe chronic heart or renal disease — problems that should have been detected and would have made them eligible for retirement. While laboratory directors have sometimes claimed that sick chimpanzees get better medical care in the laboratories (18–20) than in the sanctuaries and so should remain there, there is little evidence in this review to back their claims. According to the autopsy records, many (but not all) of the chimpanzees who died in a laboratory, did have veterinary examinations and did receive medication, but so did the chimpanzees who died in sanctuaries. However, despite the asserted level of medical care given to them in the laboratories, many chimpanzees were not correctly diagnosed to be as sick as they were. The evidence also suggests that sometimes the laboratories did not take sufficient precautions to ensure their safety, as in the case of repeated accidental electrocutions and the frequent deaths of infants (see Appendix 1).

Conclusions

Along with the ethical issue of whether or not sick and terminally ill chimpanzees should remain available for future research, there is ample scientific reason to remove them from consideration for current or potential research. Findings from chimpanzees who were already ill would be impossible to interpret. Furthermore, even if having a specific illness were deemed to be important in a given protocol, such research would not have been scientifically sound, since most of the chimpanzees had more than one significant concurrent disease, which would confound the interpretation of any data obtained.

The results raise important questions, and suggest that there is a significant probability that many of the chimpanzees now held, or used, in US laboratories have severe chronic illnesses like those who have already died. If so, these chimpanzees should be removed from research, or possible research use, with immediate effect and retired. Given the limited and questionable scientific necessity for them (confirmed in the IOM report), as well as the contemporary ethical and moral debate concerning their use, it would be unscientific and unethical for laboratories to retain sick chimpanzees (see Appendix 1).

The conclusions are clear. Distinct criteria for mandatory retirement must be established, instead of leaving the decision up to individual laboratories. Prior studies have documented the psychological suffering of chimpanzees in and from laboratories, and the many ways in which such stress could negatively affect research data. Chimpanzees manifesting outward symptoms of severe and chronic stress (over-grooming, dissociative behaviours, withdrawn affect, etc.) should therefore be considered not to be needed or useful for research, and should be retired. As revealed by this study, clear and strict criteria for retirement are an urgent necessity.

Based on the findings in this autopsy review, a significant number of chimpanzees now housed or maintained in US laboratories for current or future research use are likely also to be suffering from chronic severe multi-organ medical illnesses, and not useful for research. Chimpanzees should be observed carefully for subtle changes indicative of illness or stress, and their required annual examinations should include a thorough cardiac, hepatic, and renal evaluation. If found to have any cardiac enlargement (especially atrial dilatation or ventricular hypertrophy), arrhythmia, elevated blood urea nitrogen or liver functions, progressive weight loss, muscle wasting, or other signs of significant illness, then that individual should be retired from research and immediately sent to sanctuary. Symptoms that are harbingers of severe chronic illness and/or the high likelihood of sudden death, as well as the manifestations of psychological stress and suffering as previously described elsewhere, must be included in newly-defined and rigidly-enforced criteria for chimpanzee retirement.

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Appendix 1: Additional relevant information

The number of chimpanzees retired under the CHIMP Act

Since the passage of the CHIMP Act, a total of 161 chimpanzees have been retired to Chimp Haven, the only federally supported chimpanzee sanctuary. As of January 2012, 119 of those chimpanzees were still living at Chimp Haven (K. Allen, personal communication, 6 January 2012). Thus, an estimated 26% of those retired under the Act have died. The 161 chimpanzees retired under the Act since 2000 represent an average of approximately 16 chimpanzees per year, or only two chimpanzees per year per federally supported, or owned, laboratory that houses chimpanzees. The total number of chimpanzees held in all laboratories remains, as of January 2012, at an estimated 1000. As of August 2011, a total of 590 chimpanzees were living in ten US sanctuaries and one Canadian sanctuary. This includes the 119 animals living at Chimp Haven. The vast majority of the remaining 471 (590 minus 119) chimpanzees now in private sanctuaries (including those in the Canadian sanctuary), were retired, or were rescued from various US private laboratories that had closed or ended their use of chimpanzees. None of these 471 had been retired under the provisions of the CHIMP Act.

Infanticides

Soon after this study was completed, 14 additional autopsies were obtained from NIRC on infants aged from newborn to 8 months, who had died between August 2000 and July 2008. The autopsy reports were each less than a page of largely external gross examinations, with no internal organ examination or histopathology. All of them showed the infant deaths to have been from severe trauma, multiple fractures, bites, and abrasions inflicted by cage mates. Due to the time when they were received, they were outside the parameters of this review. However, the infants deserve recognition, and their autopsies deserve mention, since they reveal severe trauma and negligence in providing adequate protection for them. Infanticide has been seen in the wild at times of socio-ecological stress. In the laboratories, the stress of captivity could also be a factor (21).

Autopsies from privately-owned chimpanzees

Twenty-seven additional autopsies of non-government owned chimpanzees from NIRC were received after the study was completed. Ten were of infants aged one year or younger. The remaining 17 ranged in age from eight to 34 years, with five females and 12 males. Of this total, 68% were noted to have multi-system disease.

Appendix 2: Pathologists

Nancy L. Harrison MD
Board-certified Pathologist
MD, University of Oklahoma College of Medicine, 1986
Pathology Residency, University of California San Diego, 1991
Private practice for 25 years

Martha Hutchinson PhD MD
Board-certified Pathologist
BS with honors, Iowa State University, 1963
PhD, Purdue University, 1970
MD, Case Western Reserve University, 1974
Associate Professor of Pathology, Brown University
Consultant Pathologist, Women and Infants Hospital of Rhode Island
Author of over 100 manuscripts, book chapters, and abstracts in nutrition and pathology

Richard M. Jakowski DVM PhD
Board-certified Veterinary Pathologist
BS with honors, University of Hartford, 1963
DVM with honors, Michigan State University, 1967
PhD, University of Connecticut, 1972
Author of over 40 journal articles and chapters on veterinary pathology
44 years experience
Associate Professor Emeritus, Tufts University School of Veterinary Medicine