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Who reviews what you do at the zoo? Considerations for research ethics with captive exotic animals

Eduardo J Fernandez
University of Adelaide, Australia

Todd J McWhorter
University of Adelaide, Australia

Abstract

Research in zoos is an important scientific endeavor that requires several complex considerations in order to occur. Among those many considerations are the ethics involved in conducting zoo research. However, it is not always clear how zoo researchers should go about resolving any research ethics matters, even determining when *some* type of research ethics committee *should* be involved in those deliberations. Our paper attempts to provide some resolutions for these issues, namely in three sections: (1) a brief history of human and animal research ethics, (2) general guidelines for zoo research ethics applications, and (3) theoretical, ethical dilemmas at the zoo. In each section, we consider pragmatic attempts to resolve any issues, as well as provide examples to illustrate our points. The primary focus of the paper is to facilitate consideration of the wide array of ethical factors any zoo researcher might encounter, as well as provide a basic set of ethical guidelines for zoo research. We also emphasize the importance of the welfare of the animals for all zoo research projects.

Keywords

Animal ethics, animal research, animal welfare, ethics committees, zoos

Corresponding author:
Eduardo J Fernandez, School of Animal and Veterinary Sciences, University of Adelaide, 1454 Mudla Wirra Road, Roseworthy Campus, Adelaide, SA 5005, Australia.
Email: eduardo.fernandez@adelaide.edu.au

Isaac Asimov once remarked, "The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom" (Asimov and Schulman, 1988, p. 281). This observation of the potential mismatch between the state of the science of a given field and the behaviors of those doing the science can be readily seen in zoo research. While continued calls for more research collaborations between zoos and academic institutions are pushed forward (Fernandez and Timberlake, 2008; Schulz et al., 2022), past and current researchers have raised concerns about what zoo scientists decide to research, including potential shifts in basic/applied research dichotomies (Kleiman, 1992; Rose and Riley, 2021). While some researchers have called attention to the plans we make for zoos and their research, including conservation-related determinations for the animals a zoo might exhibit (Hutchins, 2003; Hutchins et al., 1995), others have questioned what we know about conservation action and awareness, particularly that of the zoo visitor themselves (Godinez and Fernandez, 2019; Learmonth et al., 2021). The simple point is that there is a possible disconnect between the research that is being conducted in zoos and the reasons we create (*a priori* or *post hoc*) for doing such research. Nowhere is this more evident than how we decide what research is ethically or socially valid for us to conduct. The process by which we determine what research in a zoo can be conducted and what ethical considerations need to be made appears at least partially unclear.

For this reason, this paper aims at clarifying two points, one of which can be summed up in a single statement:

Yes, your zoo research requires examination by an ethics committee.

It is certainly rare that a scientist of any field or stature can make such a non-contextually bound statement. Nonetheless, we believe the above statement to be true, and necessary to state. While we know of no data informing the public how often zoo researchers have ethics review for their research, it is at least the first author's anecdotal experience that many of the zoo research papers he is asked to review have no ethics approval listed in their manuscript. Nonetheless, it is not clear whether this implies a lack of ethics approval or is simply a lack of reporting. Similarly, while a considerable number of zoo studies, particularly research involving behavioral welfare, are observation-only and require little more than some type of ethics review committee's exemption, this is still based on the determination of the ethics committee itself. It is necessarily incestuous that any zoo research ethics-based permissions would be decided by the researchers doing the research themselves. Therefore, we believe the statement that all zoo research requires some type of examination by an *independent* ethics committee holds true. In the absence of a systematic assessment of zoo ethics protocols, our intent in this paper is to provide a framework to facilitate increased awareness of the need for ethics review and procedures involved.

We aim to tackle the function of zoo research ethics in three sections: (1) a brief historical introduction to research ethics involving both people and animals, (2) general guidelines for how to apply for zoo research ethics approval, and (3) potential theoretical, ethical dilemmas zoo researchers might encounter. With each section, we attempt to provide both a pragmatic set of rules and purpose for external ethics reviews of any zoo research that might be conducted. Our hope is that this paper can provide a one-stop shop for both new and veteran zoo researchers to facilitate having proper ethics approval for conducting their research and reporting ethics approvals accordingly. In other words, our aim is to enhance the likelihood that all zoo research is as ethical as possible.

A brief history of human and animal research ethics

The following section is split between two areas: (1) human research ethics, and (2) animal research ethics. While the latter may seem more relevant for zoo research, much of what ultimately led to the development of animal research ethics was initially guided by human research ethics. In addition, particularly with the increased interest in animal-visitor interactions and visitor experiences (Fernandez and Chiew, 2021), it is important that we outline some of the main principles that are involved in human research ethics. Finally, we want to emphasize the brevity with which we have approached each of these research ethics area histories. Our only purpose is to highlight some of the guiding principles and the events that led to their creation.

Human research ethics

Much of what we think of in terms of modern-day research ethics stemmed from two events: (1) Nazi experimentation on humans during WWII, and (2) the Tuskegee syphilis experiments that occurred from the 1930s to the 1970s (Hardicre, 2014). The former events led to Nuremberg Code of 1948 and the Declaration of Helsinki in 1964, both of which emphasized voluntary consent of human subjects and a greater benefit to cost ratio for any research (Mandal et al., 2011). In addition, the Declaration of Helsinki and its later revisions helped establish and refine independent review committees (Carlson et al., 2004).

The Tuskegee syphilis experiments involved monitoring several hundred African American males with syphilis over several decades. In many cases, the subjects were directly infected with syphilis, and in all cases, the subjects were prevented from obtaining penicillin, a known cure for syphilis that was developed in the 1950s. While the study ran for 40 years, the results were not known to the public until the 1970s, which also resulted in the creation of the Belmont Report (Beauchamp, 2008). The Belmont Report established three primary ethics

principles necessary for conducting human research: (1) beneficence, (2) justice, and (3) respect for persons (Sims, 2010). Beneficence focuses on not harming the subject, where any benefits must outweigh any possible harm. Justice requires that the subjects of any study can benefit from that line of research, rather than potential benefits going primarily to other groups. Respect for persons necessitates that people be aware of and voluntarily participate in research. Subjects, as autonomous agents, should have the right to knowingly decide whether to be involved in some study.

Together, the Nuremberg Code, The Declaration of Helsinki, and the Belmont Report, including all their revisions, still dictate much of how all ethical standards for human research are conducted. These ethical principles helped determine the need for and guide the development of animal research ethics, as we illustrate below.

Animal research ethics

Animal research ethics have largely evolved from two general concepts: The Five Freedoms (McCausland, 2014) and the Three Rs (replacement, reduction, and refinement alternatives) of animal experimentation (Festing and Wilkinson, 2007). In addition, organizations such as the American Psychological Association publish guidelines for animal research (American Psychological Association [APA], 2022). For our purposes, we will focus on the former, since both zoo welfare and research ethics have been more directly influenced by the Five Freedoms and their derived Five Domains.

The Five Freedoms, developed by the Farm Animal Welfare Council (FAWC) in the 1960s, provided a set of minimum standards that guided how captive animals were housed. These primarily focused on freedoms "from" events, such as freedom from hunger or thirst and pain or injury, with the one freedom "to" event focused on the freedom to express normal behavior. One of the many criticisms of the Five Freedoms was this attention on "from" rather than "to" events, which places the focus on negative rather than positive welfare (McCulloch, 2013). For this reason, there has been a more recent focus on the Five Domains model of animal welfare (Mellor, 2016; Mellor and Reid, 1994). In the Five Domains model, freedoms "from" events, such as hunger or thirst, are emphasized as freedoms "to" events, such as proper nutrition. This movement has been beneficial to emphasizing the importance of positive welfare research, including assessing and improving zoo welfare research efforts and human-animal interactions (Mellor et al., 2020; Sherwen et al., 2018). The result has also emphasized the importance of understanding the connection between science and ethics, particularly for animal research in applied settings such as zoos.

General guidelines for zoo research ethics applications

In the following section, we consider some of the essential features necessary for ethics approval for any proposed zoo research. This process usually involves two components: (1) application for research ethics approval prior to the start of any research project, and (2) selection of the appropriate research ethics review committee. The former is a necessary component of any zoo research project; one should not begin data collection or attempt to receive research ethics approval following the start of data collection (for many publication journals, this is an absolute requirement). However, the latter component may not always be clear, as many zoos have independent internal research ethics review committees. The general rule is that if the research project involves academic personnel, it requires being examined by a university-based research ethics review committee. Similarly, when government scientists are involved in zoo-based research projects external ethics review is usually required, which may occur via an independent government animal ethics committee or a university-based committee. In both cases, it is the responsibility of the animal ethics committee to ensure that the proposed research adheres to the animal use legislation that applies in a given jurisdiction.

While the exact membership of and quorum requirements for research ethics committees is determined by relevant legislation in a particular jurisdiction, some general principles apply. Animal ethics committees are typically comprised of (1) members of the public (laypeople), (2) persons with expertise and/or interest in animal welfare, (3) researchers or teachers currently working with animals in the course of their work, (4) animal care staff, (5) veterinarians, and (6) a convener. Human ethics committees are typically comprised of (1) laypeople (often gender balanced), (2) persons with professional experience in the counseling or treatment of people, (3) researchers experienced with human studies, (4) pastoral care workers, (5) legal counsel, and (6) a convener. This breadth of perspective and expertise is an essential part of maintaining the social license to conduct animal and human research, meet compliance requirements, and calibrate welfare standards and outcomes to current societal expectations. Because the laws governing research ethics vary amongst jurisdictions and change through time, we do not deal with the particulars of legal compliance here. The Global Animal Law Association maintains a current database of worldwide legislation related to animal use (https://www.globalanimallaw.org/database/national/index.html). A critically important point to note for the preparation of research ethics applications is the required presence of laypeople on both animal and human ethics committees in many jurisdictions (e.g. animal ethics committees in Canada, Australia, Sweden and the USA). This generally means that applications should be written in lay terms, avoiding jargon as much as possible and clearly defining technical terms when unavoidable, to ensure

that all committee members including non-specialists in particular areas can understand the ethical implications of the proposed research.

To facilitate understanding the general guidelines for research ethics applications, we have split this section into three areas: (1) behavioral research ethics, (2) physiological research ethics, and (3) human research ethics. Under each area, we outline the major features necessary to consider for each type of research project, as well as provide examples of how this might work.

Behavioral research ethics at the zoo

One of the primary types of research conducted in zoos involves behavior. In many cases, this may incorporate welfare-oriented research, such as the introduction of environmental enrichment (Fernandez and Martin, 2023; Mellen and Sevenich MacPhee, 2001). The behavioral observations themselves usually require consideration of many variables, including the creation of ethograms or behavioral inventories and how behavior will be sampled and recorded (Brereton et al., 2022; Rose and Riley, 2021). While consideration of such variables is beyond the scope of this paper, it is worth considering two factors that should influence the research ethics review process: (1) whether the research will simply observe zoo animals, or will it involve some type of experimental manipulation, and (2) the basic or applied research question(s) that drive the study.

Regarding the observation-only versus experimental manipulation of some variable, this is typically easy to answer by a simple question: Does the research require some type of change to the exhibit or the housing of the exhibited animals? This can include the introduction of stimuli, such as enrichment items, as well as changes in feeding times, number of animals housed together, or external events, such as off-exhibit husbandry training procedures. The point is that any manipulation of any variable moves the study beyond observation-only and should be detailed as such. In addition, while observation-only studies may require minimal research ethics review (note: they still require some type of examination by a research ethics review committee), an observation-only study may still require ethical consideration of variables manipulated by the zoo itself and that the researchers passively observe. For instance, the zoo may change the number of animals housed together in some exhibit, whereas the researchers only engage in observational research of such changes and compare differences between the housing arrangements for those animals (for a detailed example, see Fernandez and Harvey, 2021). Considerations for such quasi-experimentation/observation-only research will be detailed further in the Theoretical, Ethical Dilemmas at the Zoo section.

The basic/applied research question that drives a study can and should impact its evaluation by a research ethics review committee. In many cases, behavioral

research in zoos is expected to have some type of welfare benefit. Nonetheless, the basic/applied research question is a spectrum, not a dichotomy, and in many cases, even primarily basic research questions can have clear applied benefits. For example, contrafreeloading is a basic research phenomenon where animals in laboratory studies will choose to work for food, such as pecking a key or pressing a lever, over freely available food (Inglis et al., 1997; Jensen, 1963; Neuringer, 1969). More recently, zoo researchers have examined this basic research phenomenon by comparing scattered versus non-scattered feedings in exhibited maned wolves (*Chrysocyon brachyurus*; Vasconcellos et al., 2012) and by manipulating the difficulty in obtaining food from enrichment items in giraffes (*Giraffa camelopardalis*; Sasson-Yenor and Powell, 2019). In both cases, the zoo researchers were able to collect important behavioral data relevant to contrafreeloading, while simultaneously increasing enrichment opportunities for the animals in their studies. Behavioral researchers in zoos should be clear to outline all these potential benefits, when possible, in their research ethics applications.

Physiological research ethics at the zoo

Another primary type of research conducted in zoos involves measuring physiological outcomes in response to experimental manipulation (e.g. nutrition studies; modification of environmental conditions) or physiological sample/data collection (e.g. blood; saliva; urine; feces; vital signs) and can also include harvesting of information from existing databases. In many cases, this research is welfare-oriented and may be conducted in conjunction with behavioral studies. Many different types of direct and indirect data are collected in physiological studies, including body mass or condition, stress mediator or other hormone (or metabolite) levels, growth rate, digestive efficiency, metabolic rate, or reproductive output/success. Consideration and enumeration of these particular variables and their application is beyond the scope of this paper, but it is worth considering three factors that should influence the research ethics review process: (1) whether the research will collect samples in a non- or minimally-invasive manner or involve some type of experimental manipulation or direct sample/data collection, (2) whether the study is harvesting existing data from veterinary or management databases or scavenging animal samples or tissues collected during veterinary care, and (3) the basic or applied research question(s) that drive the study.

Regarding the first question on the invasiveness of sample collection methodology, studies that do not require any change to an animal's daily routine, feeding or housing or direct contact for sample/data collection are usually considered to be less invasive. A common example of non-invasive or minimally invasive sampling is collection of feces when animals are off-exhibit, or when keepers enter exhibits to conduct routine cleaning, in order to measure hormone metabolite levels to

assess stress responses or monitor welfare (Brown et al., 2019; Ozella et al., 2015; Xie and McWhorter, 2021). Animal ethics committees are required to assess the invasiveness of sample collection/experimental manipulations as part of the review process, so it is important to consider whether less invasive methods can be used (an example of refinement) and clearly state when this is the case, or provide a clear rationale for more invasive methods.

Harvesting of existing data from veterinary or management/husbandry databases (e.g. ZIMS zoo aquarium animal management software) and informal institutional animal reports can be a useful tool for answering a variety of research questions. Because such data have already been collected by veterinary or other zoo staff members, *external* ethics review is generally not required but approval or review by internal zoo processes, management, or research committees is generally required for both internal and external researchers. Such databases can be particularly useful for studies involving reproduction, nutrition, injuries, pathology and disease outbreaks, and for tracking collection or population level trends in health and welfare (Barber, 2009). These approaches have perhaps been underutilized to date but have the potential to advance animal welfare science using meta-analytical, epidemiological, and phylogenetic approaches (Mellor et al., 2018). Importantly, academic researchers should note that providing access to sensitive data to scientists outside of the zoo and aquarium community might be considered a risky proposition, and so zoo management and research committees may be very conservative in granting permission.

Scavenging of "leftover" samples collected during the course of normal veterinary care or animal carcasses or tissue samples stored in zoo freezers is another useful tool for physiological studies that typically requires only cursory examination of the relevant external animal ethics committee, and not full ethical review. Animal ethics committees frequently have "scavenging notifications" on meeting agendas, and these activities are viewed positively in that data can be collected without additional direct animal use (reduction). In both cases, it is advisable for researchers to contact the relevant animal ethics committee secretariat to confirm reporting and review requirements, as full review may be required in some cases (e.g. non-human primate studies).

As with behavioral studies, the basic/applied nature of the research question that drives a study falls along a spectrum and is not a dichotomy. In many cases, physiological research in zoos is expected to have some type of direct welfare benefit, such as monitoring stress responses in the context of animal relocations, changes, or repairs to exhibits (Xie and McWhorter, 2021) or construction (Jakob-Hoff et al., 2019). However, even primarily basic research questions can have clear applied benefits for captive populations. For example, pathogen studies in zoo animals can assist in identification and management of disease outbreaks (Greenwood et al., 2012) and nutritional studies in wildlife and domestic animals

can improve diet formulation (Kawata, 2008). Benefits of basic research can extend to threatened species breeding and reintroduction efforts led or facilitated by zoos and the conservation of species in the wild. Like behavioral studies, researchers collecting physiological data in zoos should clearly outline the direct benefits and potential application of research outcomes to provide the best context for review by research ethics committees.

Human research ethics at the zoo

As noted earlier, zoo researchers have become increasingly interested in animal-visitor interactions (AVIs; Fernandez et al., 2009; Sherwen and Hemsworth, 2019), including the effects of the exhibited animals and the zoo itself on the behaviors and perceptions of the visitors (Godinez and Fernandez, 2019; Learmonth et al., 2021). When these studies have involved people as research subjects, this has necessitated obtaining proper human research ethics reviews and approvals, which themselves are often separate review committees than those for animal research. For instance, in the U.S., animal research ethics are typically reviewed by an Institutional Animal Care and Use Committee (IACUC; Silverman et al., 2014), whereas human research ethics are typically reviewed by an Institutional Review Board (IRB; Amdur and Bankert, 2010). In some jurisdictions there are additional regulations that govern the handling of human data, such as the General Data Protection Regulation (GDPR) in the European Union (https://gdpr-info.eu/). Thus, it is critical that zoo researchers considering some form of human observation or measurement in their study evaluate whether they need separate animal and human review committees examine their research proposal.

Human research ethics considerations also have separate demands, for example voluntary participation in research (i.e. informed consent) and anonymity. In many cases, human research ethics review applications will ask researchers to specify these safeguards, but it is still important for zoo researchers considering some aspect of human involvement in their research be aware of and account for such concerns. For example, Altman (1998) examined the types of conversations visitors had in relation to different bear exhibits and activity levels at the Philadelphia Zoo. To do this, she recorded visitor conversations at the exhibits and later analyzed the conversations for categorial content (e.g. animal-directed or human-focused conversations). Beneficence and justice for the participants were likely maintained because the study was unlikely to cause harm and no unfair research participation burden was placed on the visitors, respectively. In addition, signs were posted at the entrance gates letting visitors know their conversations might be recorded. Further, individuals did transcriptions of the conversations independent of the direct research observations, thus implying some level of anonymity. Nonetheless, it is not clear the respect for persons as an ethical principle was

maintained. For instance, did this research project protect subject anonymity and ability to voluntarily participate in the research? These questions should be considered by researchers when developing their research methods and can only be resolved by evaluation from a human research ethics committee.

Theoretical, ethical dilemmas at the zoo

The unique settings of zoos create a number of possible ethical dilemmas for researchers, in part because of the multifaceted purposes of zoos. Unlike laboratory settings, where the animals primarily exist for the purpose of the research, zoos must balance several interconnected goals, including visitor education, species conservation, and the welfare of their animals (Fernandez et al., 2009; Patrick and Caplow, 2018). As such, researchers working with zoos should consider all the above, particularly how the animals might benefit from their research. Thus, even when conducting basic research in zoos, researchers should consider potential benefits of the projects for the animals and for the zoo industry itself. These considerations may not always be feasible, particularly for basic physiological research. However, as we noted previously with examples from contrafreeloading studies in zoos (Sasson-Yenor and Powell, 2019; Vasconcellos et al., 2012), there are a variety of ways in which basic research projects could provide potential enrichment opportunities for the animals. Researchers working with zoos should detail these possibilities in both their research ethics applications and any summaries of their results.

As mentioned earlier, many behavioral research projects in zoos may be labeled observation-only, in that the researchers are not directly involved in any manipulations. However, behavioral researchers may also take advantage of zoo personnel-led manipulations, such as changes in an exhibit design or the social housing of animals, and still label their research observation-only. Less clear is what this means for any research ethics applications, as well as how researchers choose to resolve their own ethical considerations when passively participating in such manipulations via their observations. For instance, in two separate studies conducted by the first author, we were able to examine the effects of social housing changes on the enclosure use of African wild dogs (*Lycaon pictus*; Fernandez and Harvey, 2021) and the effects of live fish prey deliveries on the swimming activity and enclosure use of Humboldt penguins (*Spheniscus humboldti*; Fernandez et al., 2021). In both studies, we passively observed these changes that were staff-led and would have occurred regardless of our research intent, hence why we labeled the design "quasi-experimental" and the project "observation-only." However, specifically with respect to the latter live fish prey introductions, we also limited our own opinions or ethical considerations with respect to such activities, suggesting that we were simply there to observe and collect data. In hindsight, I (the first

author) believe it would have been more appropriate to submit research ethics applications listing all manipulations, zoo staff-led or not, as experimental manipulations. In addition, zoo researchers should consider their own moral positions and ethical obligations when participating in research, including whether we choose to participate in some research activity. Certainly, the use of live fish prey as potential penguin enrichment raises several ethics concern, including the welfare of the fish themselves (Oldfield and Bonano, 2023; Sánchez-Suárez et al., 2020). As such, zoo researchers should consider not just whether they are able to conduct research on some manipulation, including those led by persons other than the researchers, but whether they and an external review committee agree with the implementation of such a manipulation.

Finally, an ethical consideration for all zoo researchers is what it means to conduct research in zoos. We have previously noted the interest of others to promote greater research collaborations between universities and zoos (Fernandez and Timberlake, 2008; Schulz et al., 2022). However, it is not always clear what such research collaborations might look like, or how to proceed in collaborations that benefit both parties. At some core level, there should be a focus on the welfare of the animals, since a primary purpose for the zoo is for the existence of behaviorally and physiologically healthy animals, and researchers can help promote such purposes through their projects. In addition, zoo researchers external to a zoo organization, such as those with a university position, gain a variety of benefits from working with zoo animals, including access to a wide diversity of species in a controlled setting for students to learn about animal behavior and research methods (Hosey, 1997; Lukas et al., 1998). It is worth all parties involved in zoo research considering both how they benefit from such projects, as well as how the animals will prosper as a result of the research.

Conclusions

Research in zoos raises a plethora of ethical considerations, not the least of which involves having research proposals properly evaluated and approved. A fundamental necessity for all zoo research projects is that a research ethics review committee be involved in examining proposals prior to the start of any study. Aside from this necessary requirement, it is not always clear how zoo researchers are expected to proceed. In our paper, we have attempted to detail numerous ethical considerations zoo researchers might encounter, including providing a brief history of human and animal research ethics, general ethics proposal guidelines for behavioral, physiological, and human research conducted in zoos, and some ethical dilemmas researchers working with zoos might encounter. One of our goals is to provide a framework that can be used for navigating zoo research ethics. Additionally, we hope zoo researchers will consider the broader concept of ethics

when creating, implementing, and reporting any project. This includes welfare considerations for the animals being studied, as the well-being of the animals is critical for both the zoo and the research alike.

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ORCID iD


Eduardo J Fernandez https://orcid.org/0000-0001-5444-6604

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