Veterinary Studies and Captive Propagation

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Introduction

Veterinarians have been associated with the care of zoo animals either directly or as an adjunct to their normal veterinary practice for a number of years (Fox, 1923; Hahn, 1967; Fowler, 1974, 1976). Their accumulated experience has resulted in textbooks gathering together the available veterinary information on zoo animal species (Klös & Lang, 1976). Many are the references which guide the veterinarian with respect to the care and treatment of animals in the wild (e.g. Woodford, 1965; Debbie, 1971), but to these relatively early beginnings much more recent information has now been added (e.g. Wallach & Boever, 1983; Fowler, 1986, 1993; Nettles, 1992; McKenzie, 1993; Ritchie et al, 1994; Göthgenboth & Klös, 1995).

The need to encourage further activity from veterinarians stems from the nature of the changes taking place in species being maintained in zoos. There is a move away from the more common species of 'exotics' to those species which are being identified by groups of specialists belonging to the International Union for the Conservation of Nature (IUCN) and the captive breeding specialist group (CBSG) as the threatened and endangered species of the world (Collar et al., 1994, Groombridge, 1994).

Although the situation for many species is now critical, much can be done within the presently existing framework of support. The International Union for the Conservation of Nature (IUCN) is publishing a series of "Action Plan" documents which seek to survey the current knowledge and also to recognise the important gaps in that knowledge of individual species, genera, families and orders of animals, whether they be mammals, reptiles or birds. Currently these publications draw more attention to the need to conserve animals in the wild (in-situ conservation). However, in numerous cases where animals are found exclusively as small remnant populations, or where habitat destruction is ongoing and cannot be controlled, the only strategy available may be ex-situ preservation in zoos or similar facilities (Primack 1993, Seal 1988). Since in-situ and ex-situ conservation strategies must be regarded as complementary (Primack 1993, Robinson, 1992) it is within this broader context that the zoo-based veterinarian can and should co-operate.

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with biologists / zoologists to improve overall knowledge of the animals under captive management.

General applications of veterinary research

Zoo veterinarians can contribute to research and the increase of knowledge in a number of important ways. One straightforward example is by the collection of anatomical material from animals that have died in the zoo. More often than not this is neglected, and carcasses are disposed of prior to, or after a necropsy. The careful collection of such material and its storage in museums allows the establishment of reservoirs of research material for subsequent analysis. There are many different examples, but the Babirusa (Babirousa babirusa), a species of wild pig from Indonesia illustrates the benefit that can be gained. Important anatomical information of a fairly detailed nature was obtained from the study of animals of the species which died in Amsterdam Zoo (VROLIK, 1844), at the Chicago Zoological Society (DAVIS, 1940) and at the London Zoological Society (POCOCK, 1949). The study of museum-conserved specimens as well as the availability of anatomical material newly gathered from zoological gardens is continuing to make helpful contributions to the understanding of the biology of this, and many other, species (e.g. LANGER, 1973, 1988; MACDONALD et al., 1984, 1990; MACDONALD, 1988, 1991, 1993; KNEEPKENS et al., 1989). Whilst appropriate collection and storage of material should be encouraged to avoid potential loss of valuable information, it should however be emphasized that this should wherever possible integrate into a research project with clearly defined objectives. The collection and description of zoo animal material alone does not contribute directly to our understanding of biological phenomena. Biologists also have additional opportunities to increase the knowledge gained from their work; the routine trapping of various forms of wildlife in the field in order to collect primarily morphometric data can be used in a multidisciplinary way to gather veterinary medical data. Carrying out such procedures could help the biologist to obtain a broader understanding of the various biomedically interesting relationships in the researched population. For example when examining fatalities among free-ranging Pigeon-eating falcons (Falco mexicanus, Falco peregrinus) using restriction endonuclease analysis, AINI et al. (1993) made significant findings which supported observations made in the field; a pigeon-specific herpesvirus could be transmitted to the falcons where it caused a fatal infection.

The behavioural, social and environmental aspects of a zoo animal’s life are very important and may be the main cause of the disease conditions observed. These aspects have to be taken into consideration by the veterinarian, both when treating an animal and when trying to establish the cause of its death. The impact of stress on the animal which may be of social origin (inappropriate sex ratios in a group), or of environmental origin (e.g. transportation stresses, or unsuitable holding temperatures for reptiles), on the health of animals is beginning to be recognized more readily by veterinary medicine. Some of this knowledge and experience has found its way into the husbandry guidelines of EEP species; e.g. post transportation exacerbation of endo-parasitism in the Przewalski horse (Equus przewalskii) (ZIMMERMANN & KOLTER, 1992).

The number of species that reproduce within captive breeding programs has increased significantly over the past years as a result of the consistent application of the knowledge gained concerning wild animal reproduction. Nevertheless, there are species specific differences in reproductive success (IUDZG/CBSG (IUCN/SSC) 1993). For many years the captive population of Cheetah (Acinonyx jubatus) demonstrated an extremely low reproduction rate (MARKER-KRAUS 1989). However following changes in management
techniques, which took into consideration the importance of mate matching, by routinely moving female animals between holding institutions the number of captive births has increased significantly (McKeown, 1993). Primack 1993 states that the White Rhinoceros (Ceratotherium simum simum) is not amenable to ex-situ preservation as the reproduction rates are very low. In accordance with the IUDZG/CBSG (IUCN/SSC) 1993 call to improve breeding success in all animal groups collaborative work between behavioural biologists (Meister, 1994, Mikulicka, 1993), endocrinologists and veterinarians (Schwarzenberger et al. 1994, Schwarzenberger & Walzer 1995) could help to establish optimal reproductive guidelines for this species.

During the 1960’s and 70’s it was widely thought by veterinary nutritionists that all nutritional problems could be solved with well balanced prefabricated diets (Wackernagel, 1968). However the application of this notion led not only to the development of oral health problems (Fitch & Fagan, 1982, Bond & Lindburgh 1990) in cheetahs, but also to a reduction in the amount of time needed to consume the daily food, and subsequently to a reduction in the time needed to satisfy psychological needs. There was a corresponding increase in the incidence of stress and boredom among captive animals (Maple, 1979, Dawkins, 1980). Future field-based and other research studies should be conducted with a view to discovering what species of plants/substrates should be fed in order to provide the necessary nutrients not only for the animal, but also for the micro-flora inhabiting its gut. There is growing awareness that a more holistic approach to animal nutrition is of utmost importance. The subsequent adaptation and presentation of nutrients to animals should, not only satisfy physiological needs, but also fulfill psychological requirements. This strategy should be taken into consideration by any veterinarian or biologist involved with the nutrition of zoo animals.

In contrast to most farm animals, a large number of zoo animals are kept to an old age. As a consequence, they may suffer from age-related conditions such as arthritis, spondylosis and neoplasia. Studies of the development of these conditions, their consequences and possible treatment might be expected to yield results which could ease the potential discomfort of old age which zoo animals may experience. Studies of geriatric zoo animals may also contribute information which may be of benefit to human medicine.

When an animal is routinely immobilised it provides an opportunity for data collection during routine zoo or wild animal medical procedure. Examples are the collection of morphometric data, blood samples for a wide variety of reasons, such as hematology (e.g. red and white blood cell counts, differential screens), serum biochemistry (e.g. organic and/or metabolic diseases), serology (e.g. bacterial and/or viral infections) and for genetic examination. Likewise, urine samples, and if warranted, tissue biopsy samples can also be taken. Routine immobilisation also offers the opportunity for standard radiography and ultrasonographic examinations to be carried out. In our opinion, it should be a standard requirement for at least all EEP animals to develop protocols that are followed at the time of immobilisation, and that blood cells, and plasma or serum are stored for future investigations.

In cases where death of a zoo or a free-ranging animal occurs, it is essential to have a thorough knowledge of the currently available diagnostic possibilities and the relevant tissue preservation techniques. Freezing, although useful, prevents for example any histopathological examination from yielding results. Likewise, samples preserved solely in buffered formalin solution cannot be used for virological examination.

The vast amount of zoological and veterinary information available to biologists and veterinarians is increasing daily with the advent of new techniques (e.g. Ultrasonography
for vastly improved imaging of soft tissue, Computer Tomography-scans and Magnetic Resonance Imaging for greatly enhanced skeletal representation, Polymerase Chain Reaction techniques for extremely sensitive bacterial and viral diagnostics etc.). The rapid changes and advances in some veterinary specialities (e.g. avian and reptile medicine) have led to a further explosion of new specialised diagnostic and therapeutic possibilities but because of this rapid progress it is often easy to lose touch with improvements in existing techniques. Procedures such as the endoscopic sexing of birds are still widely regarded as extremely risky interventions. Closer examination reveals that this attitude often arises not from the endoscopy procedure itself, but from unnecessarily associated problems of anaesthesia caused by outdated and dangerous anaesthesia protocols. As a consequence, many projects involved with the reintroduction of birds to the wild fail to sex the birds prior to release. In the face of new knowledge it is no longer acceptable to rely on “gut feeling” to differentiate males from females. The development of veterinary knowledge and improved techniques can reasonably be expected to make the sexing of birds more precise, and thereby offer a greater contribution to the release of individuals back into the wild.

The Salzburg Zoo Hellbrunn research programme

The Salzburg Zoo Hellbrunn is similar to many zoos in that it has no defined research department and only a very limited research budget (Burton 1993). However, despite these constraints, Salzburg Zoo recognised the importance of research and has developed quite a substantial research program. The foundation of future research development was created by hiring a full time veterinarian, not only to provide health care for the animals in the collection, but also to carry out and co-ordinate research. For example close collaboration with the University of Veterinary Medicine in Vienna has led to the development of numerous projects. Extensive long term endocrinological/ reproductive/behavioural research on the White Rhino is being carried out together with the Institute of Biochemistry and the L. Boltzmann Institute of Veterinary Endocrinology (Schwarzenberger et al. 1994, Schwarzenberger & Walzer 1995) as well as the Institute of Zoology, Erlangen University (Meister 1994, Meister & Gansloser in prep). A number of different aspects of Cheetah pathology are being examined together with the Institute of Pathology and the Clinic of Radiology of the University of Veterinary Medicine in Vienna (Walzer & Heiss, 1993, Walzer & Hittmair, 1994) and the Zoo has also developed its own small field program, financed entirely by private research grants. This program is also involved with various aspects of Rhino and Cheetah health. Results obtained in the field further enhance the collaborative Rhino and cheetah projects.

In addition to these veterinary projects the Zoo also actively promotes and participates in more general “biological” projects, either as a co-researcher as in the case of the Griffon Vulture Project with the National Park Berchtesgaden, or as the provider of veterinary aid for outside research projects as in the Marmot Project of the University Marburg, or the Cormorant Project of the Bavarian Fisheries Department.

A good example of this type of co-operation between wildlife biologists and veterinarians, which has brought great advantages to both parties is the telemetric surveillance of free flying Griffon Vultures (Gyps fulvus) (Bögel 1994). The use of modern anaesthesia made the application of the backpack radiotransmitter a safe and stress-free procedure. Additional information was gained by means of endoscopy, which permitted the determination of the bird’s sex; it could also yield information on the individual’s reproductive status. At the same time, the expertise developed by experimental use of
telemetry enables the veterinarian to contribute to the welfare of recovered and injured birds. In this project, aspects such as e.g. population dynamics and long-term viability of the population, metabolic costs of flying and soaring, and home range size are being investigated.

Untapped knowledge, like hoarded research material, wherever it is located, should be explored, analysed and the results published. Where, for time or other relevant reasons it cannot be analysed, it should be made available for collaborative effort with the aim that it will subsequently be published. Publication of the results of curatorial or veterinary observations are likely to stimulate further, and perhaps more focused research. The maxim for zoo veterinarians should no longer be “Publish or perish” but maybe “Publish or some of the species for which you have veterinary health and welfare responsibilities will perish”.

Conclusions

In a practical sense, researchers can assist both themselves and zoos by first letting zoos know what material they need, why and in which form, and then by collecting the requested material from the zoo as soon as possible. The potential productivity of such a “zoo - outside researcher” relationship is beginning to become better understood, and one aim of this paper is to encourage that development. One possible form of output from such cooperation might be the preparation from anatomical material and an expanding collection of animal topographies and x-ray anatomies similar to that for domestic species in normal veterinary textbooks (e.g. COOPER & SCHILLER, 1975; DYCE et al., 1987; SMUTS & BEZUIDENHOUT, 1987; POPESKO et al., 1992; HUDSON & HAMILTON, 1993; BUDRAS et al., 1994). Examples do exist for a number of other species (e.g. ST. PIERRE, 1974; RÜBEL et al., 1991; OROSZ et al., 1992) but often the detailed information is not easily available.

The developing range of agreements between zoos, and between zoos and outside researchers with regard to animal conservation and studbook support provides a framework within which further developments in animal care may take place. We have proposed a number of ways in which the veterinarian can contribute to this development. We think that it may be important for people to have a guide to help show them where and how they can carry out studies which will be of assistance to threatened and endangered species. A first attempt at such a list of suggestions was drawn up by a group of European veterinary practitioners, students and teachers at the Erlangen meeting. The following ideas are based on that list.

i) We suggest that a set of guidelines be prepared for veterinary, zoo and field staff to enable them to collect blood and other tissue samples.

ii) We propose that the EEP chairs (and their counterparts in other regions) assign selected people to be responsible for the collection of tissue material from their respective taxon or animal group, and that these persons also function to coordinate the storage, distribution and analysis of collected material as well as publication of results.

iii) We also propose that the EEP chairs appoint anatomists and pathologists to be responsible for the description of their species or group, and in particular seek to research those aspects which may be of foreseeable therapeutic importance.

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