

Malleefowl, Orange-bellied Parrot, Regent Honeyeater, Easter Barred Bandicoot, Yellow-footed Rock-wallaby and Greater Bilby.

It has been suggested that Australian zoos should contribute a further proportion of their income towards conservation. It must be remembered that a significant proportion of funds is required for routine operations, including animal food, veterinary care and salaries of keeping staff. Major zoos are government funded and are encouraged to increase revenue in order to decrease dependence on government grants. And all zoos require grants or other forms of underwriting to enable them to operate. Thus, they have limited options for donating significant funds to conservation programs. Progress in this area will require new enterprises, and perhaps a new sense of commitment. Primates within Australian zoos can be used to promote and gain support for conservation programs. The collection of funds to support the Lion Tamarins of Brazil program has been tremendously successful at Adelaide Zoo. Staff from various zoos have made personal contributions to such programs, showing great initiative with fund-raising endeavors. Taronga staff have supported programs for Chimpanzees and Orang-utans, Perth Zoo for Orang-utans and Silvery Gibbons, and Melbourne Zoo for the Endangered Primate Rescue Center (Vietnam) and Madagascar Fauna Group. Rather than signage or other interpretive material focusing on such things as gestation periods and diets, information can be provided about conservation programs and ways in which visitors may directly contribute. And, of course, collection tins can be conveniently provided.

Future survival: the importance of primate welfare

Today's zoos are no longer places where visitors come and marvel at strange beasts from far-away lands. Zoos have an obligation to promote awareness of the need for effective conservation programs. Support of conservation is largely through public education. Its success is dependent upon effective displays, including the exhibition of healthy animals that show normal behaviors. The welfare of captive animals, including primates, underpins this objective. Zoos are working diligently to ensure that both the physiological and psychological requirements of primates are being met. We will continue to modify techniques to further improve the quality of life for captive primates. The **Primates for Primates** Conference has attracted a cross-section of the community concerned with the welfare of captive primates. It is valuable that we share our experiences and work together so as to further progress. The question with respect to welfare of primates is not whether they will be maintained in captivity but where and how they will be maintained. I believe that Australian zoos have given good consideration to primate welfare and that they will continue to regard this as an issue of major responsibility.

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Primates in captivity: why diversity matters

Dr Colin Groves
Primatologist
Australian National University

The spurious dichotomy, "human vs. animal", continues to inform most humans' attitudes towards other species, even though it is a biological nonsense. Non-humans are not just "animals"; equally, they are not just small furry humans. Each species is unique, and this has consequences for captive care and husbandry as much as for our philosophical appreciation of them. I will enlarge

upon this theme, using examples from baboons and squirrel monkeys.

Introduction

"Does the way animals behave have any implications for humans?" "Has this drug been tested in animals?" "Do animals think?"

Questions like these can be encountered everyday on TV and radio, in the press, in conversation, and even in the writings of some scientists, who should know better. They are meaningless; we have known, or should have understood, that are meaningless for nearly a century and a half now, ever since *The Origin of Species*. The term that stands in structural opposition to "animals" is not "humans", but "plants". There is no homogeneous category, "animals", that does not include humans. Animals are not all alike. Humans are animals with certain characteristics which, quite naturally, we tend to think of as highly desirable: self-awareness, language, a rich and complex mental and emotional life, and so on. Other animals approach us in these respects to a greater or lesser degree, and it is no surprise at all to find that the species which approach us cognitively are those which are most like us anatomically, physiologically and genetically. The theory of evolution predicts this. What it means, too, is that we are more likely to have some insight into the needs of the species that are closer to us. We cannot assume that we know the needs of any species at all, but we are more likely to be on the right track with those species that are more closely related to us.

Needs of different species

We need to study the requirements of each species separately. The following lists only the more obvious of the categories that we need to consider and cannot take for granted:

- **Diet.** Is the nutrient mix, and the mix of nutrients and non-nutrients such as fibre, appropriate, knowing what we do about the species' digestive anatomy and physiology? Have we provided micronutrients, such as trace minerals or Vitamin B12? Are carbohydrates presented in the right form, or are there too many refined sugars? Is the consistency of the diet adequate to ensure correct tooth wear?
- **Space.** Is it adequate for the number of individuals of the species? Is it an interesting shape? Does the species need corners to explore, even occasional changes of the entire space? Are any arboreal components properly thought out: thick or thin supports, rigid poles or flexible branches, vertical versus horizontal. Does the species need nest boxes, shelters, or even just bolt-holes where individuals can hide from human observers or from each other?
- **Social behaviour.** What is the species' typical social structure, and how is it modified by the captive conditions available? Should anything be done to modify the impact of the spatial structure on social behaviour? What levels of inbreeding seem typical of the species, and should steps be taken to reduce inbreeding in the captive group? Do social subordinates enjoy being subordinate; if not, can anything be done to modify this?

In this, I have not specifically mentioned behavioural enrichment, because this is the subject of other presentations. I would like briefly to talk about two cases where a lack of understanding of species diversity could have unfortunate consequences for their welfare.

Captive welfare of baboons

There are five species baboons, genus *Papio*. Three of these are called savannah baboons: Olive or Anubis Baboon, *Papio anubis* Yellow Baboon, *Papio cynocephalus*, Chacma Baboon, *Papio ursinus*. Between them, these three species occupy the savannah and woodland country of

southern, eastern, northeastern and western Africa as far west as Mali. Their social organization is all basically similar: typically large multimale/multifemale troops, with a stable dominance hierarchy among females and a highly unstable one among males, based on (often) very violent interactions. Males leave their troops at or before maturity, and try to join other troops. There may well be differences between.

A fourth species, the Hamadryas or Sacred Baboon (*Papio hamadryas*) lives in the semi-desert country of northeastern Africa. It lives in small groups containing one male and one to several females, with surplus males forming a bachelor band; these small groups form clans whose males are close kin, these in turn form bands, and these in turn combine in ad-hoc herds on the cliffs on which they sleep at night.

The fifth species, the Guinea Baboon (*Papio papio*) is poorly known, but may have a more hamadryas-like social organization.

I cannot possibly do justice to the complexities of savannah- or hamadryas-type social behaviour here, but they are very different. In a savanna baboon troop, the females are all close kin, whereas the adult males, in main, are not; in the hamadryas one-male troop, the females are not related to each other, but the males of each clan are related. As relatedness is a fair predictor for amicability, we can see that already this has implications for baboon husbandry. A male hamadryas herds the females in the one-male group, chasing them and biting them on the scruff of the neck; whereas a female savannah baboon moves freely throughout the troop and is not herded. Many hamadryas one-male groups have "followers", younger males who, as they mature, gradually take over the functions of the group male - sexual activity, leadership, herding - and the original male ceases to breed but often continues to hang around the group.

More than 15 years ago, the late Dr Andrew Phippard founded a colony of hamadryas baboons in Western Sydney, primarily to study the physiology of pregnancy, especially pre-eclampsia. He took pains to read and consult as widely as possible on the biology and social behaviour of the species, and kept them in small one-groups, each one being separated from the next by an enclosure containing a bachelor band. Unfortunately, he published too little on his system, but as I saw it in practice it was a real advance in welfare. Especially significant was that when a pregnancy occurred, the entire one-male group would be transferred to the lab and kept together while the female's pregnancy was monitored. In one of the few published descriptions of the operation, Horam et al. (1992) described it all too briefly and recounted how they mimicked the natural system of changes with the aging of the male.

Unexpected diversity among Squirrel Monkeys

The species of Squirrel Monkey (*Saimiri*) are supposed to be very closely related; indeed, there has been controversy over whether there actually are more than one. Three of them (*Saimiri sciureus*, *S. boliviensis*, *S. ustus*) are known to hybridise where their ranges abut in the wild; a fourth (*S. oerstedtii*) is geographically isolated from the rest. A fifth species, *S. vanzolinii*, was described in 1985, but little is known about it. Hershkovitz (1984) divided the species into two groups, which he referred to as the Gothic Arch and Roman Arch kinds, referring to the way the white brows arch above the eyes. He listed behavioural differences as well as morphological. Recently Boinski and Cropp (1999) added considerably to the list, and in addition described some differences between two species of the Gothic group. So we have three closely related species of squirrel monkey differing so dramatically in their behaviour that what applies to one does not apply to the others.

The first difference to be described between Gothic and Roman types of squirrel monkeys was that males of the Gothic group display to one another - or to their reflections in a mirror - with a penile erection, whereas those of the Roman group do not. We now know, because of Boinski & Cropp's work, that this is because in Gothic Arch squirrel monkeys the males are an integrated part of the troop, and form a dominance hierarchy within it - and the penile display is one way in which dominant males cower their subordinates. On the other hand, in Roman Arch squirrel monkeys the males are peripheral to the troop, and subordinate to its females, who form coalitions which compete with each other. In general, Roman Arch squirrel monkeys are noticeable less docile, more active, more aggressive. The basis of all this seems to be that males of the Roman type stay within the troop in which they were born (and so females in a troop tend to be related to each other), whereas males join the troop from outside or even form separate bachelor bands; in the Gothic type females emigrate from the troops in which they were born, and join other troops, but the males stay in the troops of their birth. This has other consequences too: Gothic males are very vigorous in defending the troop's infants from predators, but Roman males appear less concerned.

More difficult to relate to this basic difference - who emigrates and who stays - are factors like the birth interval. In the Gothic type, the typical interval between births is a year; the Roman type, two years. Gothic infants are weaned much earlier, at about six months, but Roman infants suckle for a year and a half. Births are closely synchronized within a troop - within the space of one or two weeks - in Gothic squirrel monkeys, but much less closely (within two months) in Roman ones. Boinski & Cropp (1999) found a few differences between two Gothic Arch species. The South American *Saimiri sciureus* males do show some aggression towards one another, whereas the Central American *Saimiri oerstedtii* males are rarely aggressive, and the sexes in the troop or more egalitarian whereas in *S. sciureus* the males are clearly the dominant sex. A final difference is that allomothering, which means females looking after infants who are not their own, is not seen in the Central American species but it does occur in the other two.

Consequences

What does this mean for the welfare of captive primates? It means that a monkey is not just a monkey; even, a squirrel monkey is not just a squirrel monkey. We cannot predict how all species behave from knowing about just one; in fact, we cannot predict how any other species behave.

The sheer extent of natural biodiversity is a continuing source of astonishment and delight. Let us not forget how all-pervasive it is, and how, if we wish to do justice to nonhuman primates under our jurisdiction, we need to be prepared for unsuspected diversity even in the narrowest corners of primate life.

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