

PREFACE

Primates use four major modes of communication (i.e., visual, olfactory, tactile and vocal), and the ways they communicate depend on restrictions imposed by their habits and habitats. This book discusses past, current and potential future research in the wild and captivity, addressing some of the key questions in primate bioacoustics, identifying gaps in our knowledge, and also describing basic methods and equipment used in the study of primate bioacoustics. Also investigated are the changes of circadian rhythm of the hypothalamic-pituitary-adrenal (HPA) axis activity in nonhuman primates under stress and during aging. This book presents data collected from gibbons in a sanctuary, a rehabilitation center and also the wild highlighting the development of social skills and cognitive abilities. In addition, one of the dominant research areas in behavioral primatology pertains to assessments of the cognitive capacities of various nonhuman primate species. This book outlines studies that compare different methodologies and how those methodologies might contribute to differential learning and cognitive performance. Other chapters in this book examine the cognitive differences between humans and apes, review a powerful experimental methodology to determine the most likely acquisition modes responsible for primate "cultural" patterns, estimate home range use, activity patterns, and diet in woolly monkeys, and discuss the researchers role in preventing disease transmission between humans and apes.

Chapter 1 - Primates use four major modes of communication (i.e. visual, olfactory, tactile and vocal), and the ways they communicate depend on restrictions imposed by their habits and habitats. Primates have varied and complex social systems and vocal communication seems to be an important tool used by these animals to coordinate their sociality. Although vocal repertoires have only been described for approximately 10% of the approximately 645 primate species and subspecies documented so far, vocal communication has received considerably greater attention from researchers than the other communication systems. Previous research on primate bioacoustics has shown, for instance, that knowledge on vocal repertoires may help to: (i) solve taxonomic issues, considering that vocalisations are often species-specific; (ii) improve primate welfare in zoos and laboratories; and (iii) aid surveying primate species in areas where it is difficult to conduct visual surveys. In addition, the physical structure of certain vocalisations can often reveal important information about the caller, such as sex, age, social and behavioural context. Thus, studies on primate bioacoustics clearly generate a greater understanding of primate social ecology and behaviour. In this chapter the authors will discuss past, current and potential future research in the wild and captivity, addressing some of the key questions in primate bioacoustics,

identifying gaps in our knowledge, and also describing basic methods and equipment used in the study of primate bioacoustics.

Chapter 2 - The hypothalamic-pituitary-adrenal (HPA) axis is all-important adaptive neuroendocrine system with the circadian periodicity in the activity. There is some evidence to suggest that the circadian periodicity in functioning of the HPA deteriorates with aging and that these disturbances play an important role in age-related changes of glucocorticoid-sensitive tissue functioning, inadequate reaction to stress and high frequency stress-related pathology in aged individuals. Unfortunately, up to now there have been some unclarities in the character and mechanisms of age-related disturbances in circadian rhythms of corticosteroid production. One of the possible causes of this unsolved problem is the use of inadequate experimental nocturnal models—laboratory rodents—in which the circadian rhythm of the HPA activity is in contrast to that in humans and nonhuman primates.

The purpose of this chapter was to investigate changes of circadian rhythms of the HPA axis activity under stress and during aging as well as to evaluate the role of age-related disturbances in melatoninergic and vasopressinergic regulation in their development.

Female *Macaca mulatta* monkeys of 6–8 years (young) and 20–27 years (old) were subjected to acute psycho-emotional stress (two hours immobilization), corticotropin-releasing hormone (CRH) or arginine vasopressin (AVP) injection at 0900h or 1500h on the background of placebo or a pineal tetrapeptide Ala-Glu-Asp-Gly (epitalon) administration (10 µg/animal/day, 10–14 days) as stimulator of the pineal melatonin secretion.

In response to the stress imposed at 1500h, young monkeys demonstrated much higher increase in ACTH and cortisol than to the stress at 0900h. This stress difference attenuates with aging. Compared to old animals, young ones demonstrated much higher responsiveness of the HPA axis to the afternoon stress and a tendency toward lower responsiveness to the morning stress. In response to CRH, young and old monkeys demonstrated the well-defined circadian rhythms in dynamics of ACTH and cortisol. AVP injection did not induce any circadian periodicity in the ACTH and cortisol responsiveness neither in young animals, nor in old ones. However, in response to the afternoon injection of AVP, old monkeys by comparison to the young ones demonstrated lower accretions of ACTH and cortisol without increase in melatonin. The disturbances of the circadian rhythms of the HPA axis responsiveness to AVP and stress were eliminated by epitalon.

Thus, young monkeys showed a circadian rhythm in stress responsiveness of the HPA axis. The rhythm was attenuated in old animals. The age-related changes in circadian rhythms of the HPA stress reactivity were associated with age-related disturbances in melatoninergic and vasopressinergic regulation. The functioning of the HPA was restored by treatment with epitalon.

Chapter 3 - A number of scientists have argued that referential pointing either does not occur among apes or that behaviors in apes which appear as pointing do not have the same underlying psychological mechanisms as pointing in humans does. One prominent argument advanced by Michael Tomasello suggests that cognitive differences between humans and apes preclude declarative or informative pointing in apes.

This study provides evidence that language-competent bonobos, *Pan paniscus*, do indeed point, both declaratively and informatively. Our analysis is based upon data from a video archive of naturally occurring conversations between symbolically competent bonobos and humans. Further, the authors suggest that if pointing is a learned gesture that acquires its meaning in specific communicative interactions in a culture where pointing has a meaningful

purpose, then language-enculturated apes would be expected to point in a way resembling human pointing. An ape not immersed into a culture utilizing index finger pointing, which are the majority of captive apes, would not be expected to exhibit that gesture. Tomasello's argument rests upon questionable empirical evidence, since the apes in the referred experimental studies have not been relevantly reared. By providing evidence that language-enculturated apes do point, the assumptions about the cognitive differences between humans and apes need to be called into question on both theoretical and empirical ground.

Chapter 4 - Male and female interactions are often reconstructed for fossil primates for a number of reasons: To argue that a particular social system is the primitive or ancestral form; to investigate the evolution of mating systems; to examine the potential for infanticide and female counterstrategies; and to study how behaviors like sexual selection and mate choice may have influenced primate speciation. Behavioral reconstruction from fossils is extremely limited. Yet, sexual dimorphism has been used since the 1980s to infer polygynous mating systems in early anthropoids like *Aegyptopithecus*. Rates of growth can be studied from fossil remains using a number of techniques. Despite extensive study, living primates show no good link between degree of dimorphism and social structure. Group composition can be analyzed for fossil primates (including humans) in a few rare cases. In addition to maturation rates in fossils and comparative soft-tissue evidence from living primates, group composition allows a rough outline of social structure to be reconstructed for a limited number of fossil primates. Much more attention has been directed to fossil humans, especially given the existence of multiple hominid species, and sympatry between some early species. The degree of sexual dimorphism in fossil hominids has been used to document hominid status itself and increasing hominization through time, and to infer behaviors such as pair-bonding.

Chapter 5 - Population specific behaviors shown by primates are often regarded as simple forms of culture. In some cases it has been suggested that the learning processes underlying these primate traditions may be the same as for human culture, namely, process copying (sensu imitation). For example, Mountain gorillas (*Gorilla beringei beringei*) in Karisoke, Rwanda, feed on a diverse range of defended plants by means of complex processing skills. Claims have been made that the required skills are (and must be) learned socially from each other via some form of process copying. However, in general it is often very difficult or even impossible to directly test for underlying transmission processes – especially under field conditions. In this chapter the authors focus on a straightforward and simple, yet powerful experimental methodology to determine the most likely acquisition modes responsible for such primate “cultural” patterns. The underlying idea behind this methodological approach is not a new one: if a population specific behavior represents culture then it should not occur spontaneously in naïve individuals exposed to comparable environmental affordances / constraints. Even rare instances of the same behaviour appearing in only a few naïve individuals (or even in individuals of a related species) should be taken as strong evidence against the cultural hypothesis. In this chapter the authors discuss selected publications as well as previously unpublished data of our own that has applied this methodology. The authors conclude that in general it is premature to put any population specific behavioral patterns in primates into the cultural category. Instead these behaviors seem bound and restricted by “zones of latent solutions”, i.e. the solution space set by the general physical cognitive abilities of a given species.

Chapter 6 - The authors are all familiar with the old saws the authors hear in the press of how special man is, he is the only animal to build houses, change the landscape, have

agriculture, make war. These have all long been shown false, in his delightful 1974 book von Frisch demonstrates the vast number and variety of structures animals of all kinds build and Vander Wall (1990) shows the diversity of food preparation and storage in animals, while E.O. Wilson (1975) and Chavin (1968) describe insect agriculture and warfare. Nevertheless, I am often surprised by the propensity of journalists to magnify any discovered difference between *Homo sapiens* and some other animal as a universal example of man's special place in nature. Even more disappointing is when other scientists display the same tendency. This essay will address a number of areas of *Homo sapiens*' biology and behavior in regards to distinctions with all other animals, the "special place" idea. First I will discuss ideas put forward concerning man's special biology that were argued to place us in a separate taxonomic relation. Secondly I will cover arguments that our biochemistry and molecular chemistry set us off from all other species and finally I will address the areas of behavior and sociality.

Chapter 7 - Social development and cognitive abilities in wild gibbons has received very little attention due to the difficulties of habituating enough animals for a large-scale study. Data from gibbons in captive situations (zoos, sanctuaries and rescue centers) can provide insight into the development of both social skills between individuals, and the development of cognitive abilities within the individual. Gibbon behavior in captivity has correlates to gibbon behavior in the wild and can be used to infer why certain aspects of social or cognitive behavior are seen in the more demanding and complex wild environment. I will present data collected from gibbons in a sanctuary (UK), a rehabilitation centre (Indonesia) and the wild (Indonesia) highlighting the development of social skills and cognitive abilities. Data were collected in a variety of ways and I will discuss the methods and their applicability under different conditions. Data will be presented on object manipulation and tool use and will challenge the assumptions that gibbons are inadequate tool users among the apes. I will also challenge the notion that gibbons have poor social interactions in the wild. The study of social development at all ages can shed light on how gibbon groups maintain their cohesion, not only when traveling but also how the pair bond between the adults is formed and sustained. By using both direct tool manipulation tests and non-invasive behavioral observations by studying gibbons in a variety of captive and wild situations, the authors can begin to answer more questions about the development of social behavior and its function as well as gaining insight into the problem solving and cognitive abilities of the smallest ape. With increased understanding of the development and presentation of cognitive abilities, the authors are in a better position to aid gibbons in rehabilitation and reintroduction programmes and to understand more about these apes in the wild.

Chapter 8 - One of the dominant research areas in behavioral primatology pertains to assessments of the cognitive capacities of various nonhuman primate species. Experiments in this area have shown that primates have many skills that approximate those found in humans. These tests include both manual and computerized assessments, and often the format in which tests are presented can impact the learning and behavioral responding that are produced by subjects. In this chapter, the authors outline two case studies that compare different methodologies and how those methodologies might contribute to differential learning and cognitive performance. In the first, rhesus monkeys responded during a learning task using either joysticks or touch-screens. The task assessed whether the monkeys responded according to stimulus-response associative processes or by using more relational rules about the task. Performance was similar using both input methods and suggested a more associative

response pattern. In the second case, chimpanzees and monkeys learned to sequence stimuli using either a computerized task or through selection of three-dimensional stimuli presented in a manual test. Here, the manual test produced faster acquisition and better performance than the computer task, indicating that in some contexts a hands-on, real world format may produce improved cognitive performance.

Chapter 9 - The authors estimated home range use, activity patterns, and diet in a group of woolly monkeys in Caparú Biological Station (Colombia) during 12 months. These patterns were correlated with fruit supply and compared with previous information reported for woolly monkeys. The comparison shows that the daily distance travelled and home range size were negatively correlated with fruit production. However, woolly monkeys seem to show different ecological strategies depending on the fruiting patterns at each study site. In general, woolly monkeys consume alternative resources (leaves or arthropods) when fruit supply is low, but at Caparú woolly monkeys did not decrease daily path length during periods of fruit scarcity as they do in other places. The activity patterns and diet composition seem to differ among populations, but part of the differences may be explained by the use of dissimilar methodologies. In general, studies which record behaviour by scan sampling tend to overestimate conspicuous behaviours such as movement and fruit feeding, and underestimate less conspicuous behaviours such as resting. The majority of comparative studies recommend the use of both continuous and instantaneous observations on focal individuals.

Chapter 10 - Chimpanzees and gorillas are the closest relatives of humans living on the Earth. Due to this fact they are susceptible to most of human infectious diseases, but the outcome of infection is often very different than in humans.

Chimpanzees can be infected with the HIV virus, but they never develop the actual disease. Opposite situation happens with some other human viral diseases. Common Flu, Metapneumovirus or Respiratory Syncytial Virus, which in post-infant humans are rarely considered the serious diseases, have been recorded to be fatal when transmitted to Great Apes.

In various countries in Africa researchers have witnessed numerous outbreaks of infectious, mostly respiratory diseases in ape communities, which could be traced back to humans as the source. Often most of the ape group would be affected with mortality reaching over 20%.

Gorillas in Rwanda are visited daily by the KARISOKE research team and by the trackers and tourists, which on average adds up to 2000 human visits to each gorilla per year. The numbers of respiratory cases monitored/treated by the Mountain Gorilla Veterinary Program team are at the very top on the list of the infectious diseases affecting gorillas in Virunga NP.

According to the field experience from 3 East African countries, researchers can play positive or negative, but always significant role in following the preventive visitation rules themselves and assisting the National Park offices in doing the same for the tourist visits.