

## Patterns and Functions of Grooming Behavior among the Common Indian Langur Monkey

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For many primate species grooming is a predominant and socially important behavior pattern diverse both in the form it can take and the social situations within which it is initiated. While not the only behavior that often cuts across different age and sex classes to promote cohesion, the tremendous amount of time and energy invested by some species in this activity suggests that as a bond-building mechanism social grooming has played an auxiliary if not complementary role in the evolution of primate sociality.

Among primates social grooming is thought by investigators to provide useful information on many different aspects of group life. Grooming data has been used to measure developmental processes in the mother-infant relationship (Hinde 1974, Kaufman and Rosenblum 1969), to document the growing network of attachments and subgroup formations within and among different primate groups (Simonds 1973, 1974; Furuya 1957; Kummer 1968), and as an example of parental investment (Trivers 1974, Hrdy 1976). While Sade (1965) and Lindberg (1973) demonstrated how grooming patterns reinforce social relationships and, in some cases, regulate behavior, Chance and Jolly (1970) suggested that within private societies the direction of grooming can be used as one criterion to delineate "attention structures" and to assess the degree of social centrality of leader individuals around which others are organized. More recently, Boese (1976) used data collected on preferred grooming clusters to propose that West African baboons (*Papio papio*) exhibit harem units based upon sexual but not social exclusivity.

Although an impressive number of works dealing primarily with the social functions of grooming exist, there is not unanimous agreement that grooming behavior has been interpreted and dealt with correctly, nor that its function has been entirely understood. Alexander (1974) argues that not enough attention has been given to the disease-controlling functions of grooming, particularly since grooming may have originally functioned *only* as a parasite-controlling mechanism and not as an accommodation to group living. To varying degrees Alexander's position receives support from Hutchins and Barash (1976) and Free-land (1976) who strongly argue that a much closer look at the relationship between disease pressures and social behavior is warranted.

This paper examines the forms, the contexts, and the functions of social grooming behavior among the common Indian langur monkey (*Presbytis entellus*).

These data suggest, particularly with respect to the question of functions, that while grooming no doubt serves both social and hygienic functions, it does so in a context apparently dictated by social needs. It is concluded that social grooming among langur monkeys is highly integrated into almost all aspects of group life and, while not a reliable behavioral index to status differentials between group members, it is important in assessing role complexes.

### Materials and Methods

The study group was housed in a dome-shaped mesh enclosure approximately 35 feet high by 45 feet in diameter. Starting from the enclosure floor six different levels of sitting bars and platforms, interspersed every three to five feet, allowed proper social and spatial refuge. An L-shaped mesh partition supporting plywood sitting platforms was situated in the center of the enclosure.

According to Jay's (1965) field data, the population structure included an adult male (about ten years of age with extracted canines and musculature fully developed); eight adult females (all at least six years of age, primiparous or multiparous); four immature juvenile females (all between the ages of two and four years of age); four immature juvenile males (with musculature not fully developed and incompletely erupted canines); and, finally, two dependent infants less than eight months old.

To collect data on the form, frequencies, and durations of behavioral patterns for group members three different sampling techniques were utilized: focal behavior samples, focal animal samples, and behavior spot checks. A focal behavior sample involved a fifteen minute observation period wherein all grooming activities were recorded and notation was made of which animal initiated the grooming interaction, which other animal received it, its context, and what part of the anatomy was groomed. During a focal animal sample all behavior exhibited by and toward one individual (the focal animal) during a fifteen minute observation period was recorded. The duration of the behavior, the actor, the receiver and the participants were noted. Behavior spot checks involved a random scan and periodic survey of the momentary activities of each individual at the time of observation (see Altmann 1974). Combining the three sampling procedures a total of 1500 observation hours were completed.

Tabulation of the data followed the procedure used by Lindberg (1973), in which a grooming bout was

considered to be any paired occurrence of grooming involving a recognizable actor and receiver not interrupted by a third animal or by a major relocation of one of the participants. Reciprocal grooming (animal A grooms B, then, animal B grooms A) was considered as two different bouts. If three or more animals groomed simultaneously (animal A grooms animal B while animal C grooms A), each grooming dyad was scored separately. If more than ten seconds passed between bouts, or if a grooming sequence was terminated but begun again after an individual invited a partner to resume grooming, then this was scored as a second grooming bout even though the participants had previously groomed during the sampling period.

#### Forms of Grooming

Although the contexts were varied, three types of grooming were recognized for captive Hanuman langurs: 1) relaxed social grooming, 2) tension-reducing grooming, and 3) self-grooming (see table 1). Grooming interactions involving more than one animal and *not* accompanied by aggressive or tense vocalizations, postures, and/or facial expressions (grimaces) were scored as bouts of relaxed social grooming. In contrast, any bout preceded by an embrace, a social present, aggressive behavior, a social or sexual mount, or a sexual solicitation involving tense vocalizations and/or facial expressions was scored as a tension-reducing groom. Finally, self-grooming was scored when an individual licked or picked through its own skin, hair, or teeth.

Grooming Behavior										
SOCIAL (96%)									SELF (4%)	
RELAXED (60%)					TENSION-REDUCING (35%)					
mutual (4%)	allo-grooming (53%)	reciprocal (42%)	other (1%)	following aggression (63%)	following ventral-ventral embracing (22%)	before ventral-ventral embracing (8%)	following presenting (4.2%)	following sexual solicitations (2.5%)	following social mounts (2%)	other (5%)

Table 1. Taxonomy of the forms, contexts, and percentages of different grooming behaviors observed among captive Hanuman langurs (*P. entellus*)

As Table 1 reveals, of the observed 1907 initiated grooming behaviors 60% involved relaxed social grooming, 35% involved tension-reducing grooming, and 4% involved solitary or self-grooming. Utilizing Sparks (1967) distinctions, I computed that, of the

60% (n=1146) classified as relaxed social grooming, 4% took the form of mutual grooming (animal A and B groom each other simultaneously); 53% involved allo-grooming (animal A grooms animal B); 42% involved reciprocal grooming (animal A grooms animal B, then, animal B grooms animal A); and, finally, in less than 1% of the relaxed social grooming total the form of grooming was unclear, since observation began after the animals had initiated the interaction.

Aggressive behavior preceded 63% of tension-reducing grooming bouts (667 or 35% of all social grooming bouts observed). Ventral-ventral embracing was the second most frequent behavior to precede tension-reducing grooming with 22% of the total. Sexual solicitations, social mountings, and social presenting were roughly equal in eliciting grooming responses (2.5%, 1%, and 4.2% respectively).

The third and least frequently observed form of grooming among captive langurs was self-grooming. This form of solitary skin care occurred in 4% of the total number of grooming behaviors observed. Although spatial and, therefore, social isolation often preceded self-grooming, it was certainly not the only condition in which it was initiated. Self-grooming often occurred between reciprocal grooming sessions and/or following or preceding allo-grooming by either one of the participants.

#### Frequency and Distribution of Grooming Patterns by Age and Sex Class

Figure 1 shows the percentages by which age and sex classes acted and received social grooming (relaxed and tension-reducing grooming combined). Based upon 94 fifteen-minute samples on each of the adults and immatures (excluding the neonates) and 399 focal behavior hours (1,596 fifteen-minute observation periods) I found that during any one sample period an average of 3.6 individuals could be found either as actors or receivers in grooming interactions. The adult male was involved in more grooming interactions than any other individual (331 or 10% of the total and received approximately twice as much grooming as he returned).

As an age and sex class the adult females participated in the actor role more than twice as frequently as they did in the receiver role (actor to receiver ratio for adult females was 1/2.2). While a t-test comparing the differences between the mean frequency of initiated grooming bouts per animal per class showed that adult females initiated and acted grooming at rates significantly different ( $p < .01$ ) than either immature males or females, there is much variation within age and sex classes which deserves attention. When adult females are treated as a class of individuals grouped on the basis of age and sex statuses the standard deviation was 46 and the coefficient of variation was extremely high (21.3). This figure assumes more meaning when it is considered that one adult female (Goldie) initiated far

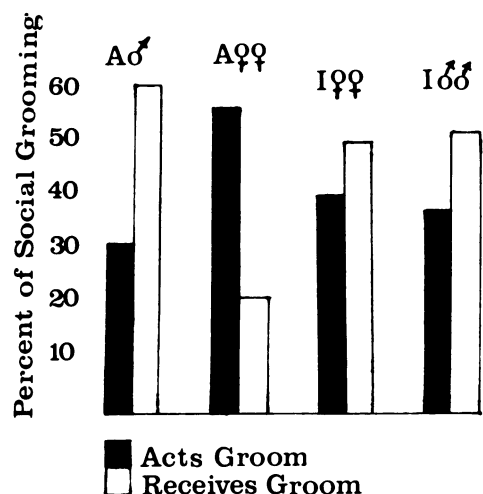


Figure 1. Percentage contribution by age and sex class to acting and receiving social grooming.

less grooming than any of the immature females and far less than one of the immature males, who topped her grooming scores by over 58 initiated grooming bouts. This kind of individual variation holds true for comparisons between other individuals of different age and sex classes as well. Therefore, it is important to realize that general interclass distinctions are often different from the behavioral records of individuals. Age and sex class membership promotes relative but not absolute interclass differences.

#### Duration versus Frequency of Grooming

Although frequency counts reveal what behaviors are more likely to be exhibited by members of various subgroups of the society, the figures, if taken alone, are inadequate or, worse, misleading. For example, the data reveal that quantitative differences of grooming interactions are sometimes less than dramatic (e.g. the adult male compared with some of the adult females); however, by examining the quality of grooming as defined by the length of time one animal actually grooms another, more meaningful differences appear. Here an extreme example can be made between the adult females and the adult male. As described previously, the adult male was involved in over 10% of the observed social grooming and during these interactions he was the recipient far more frequently than he was the actor. The grooming data are even more skewed in favor of the adult male when the duration of his grooming activities is considered. While the mean duration of social grooming by the adult females of the adult male is 4.6 minutes, the mean duration of his reciprocal grooming of the adult females was only 23 seconds (as timed by a stop watch). In general, both the frequency and quality (as defined by duration) of social grooming initiated by adult and immature females is substantially different from that exhibited by males. While females invest a great deal of

time in grooming, males invest little and receive much (see Figure 2).

Not only did adult females initiate social grooming more frequently and for longer periods of time, but their grooming networks were much more extensive. Inasmuch as 37% of their grooming was directed toward the immature males and females and 23% toward the adult male, the adult females clearly directed grooming across age and sex classes in opposite social directions. Particularly for the immature males, the social grooming by the adult females seemed to have an integrating effect. Because the adult male maintained exclusive sexual (copulatory) rights to the adult females, the immature males as potential sexual competitors had ambiguous and precarious social positions. However, the adult male threatened the immature males only when they were sexually solicited by adult females but not when they were groomed by them. Whatever peripheralizing effect the adult male may have had on the immature males, these socio-sexual proscriptions appeared counteracted by the grooming activities initiated by the adult females. Without disruption to the society, the immature males were drawn into the social nucleus of the group to establish tactile relationships with adult females.

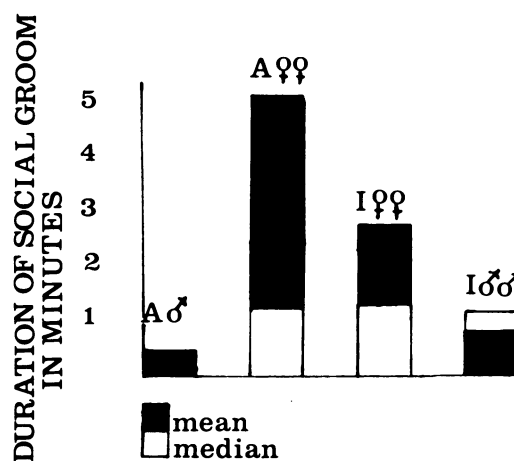


Figure 2. Mean and median duration of initiated social grooming per animal per class.

#### Grooming Invitations and Methods

The most common social grooming solicitation occurred in relaxed social settings and was scored when an actor, moving into proximity of another (within 12 inches), attempted either by watching or hand manipulation to establish visual or passive tactile contact with a potential groomer. After succeeding and while in close proximity, the actor stretched its ventrum usually in front of the receiver and while scratching its own ventrum, the actor (inviter) looked away. Although over 33% of the relaxed social grooming bouts were preceded by such a grooming solicitation, there were many variations of this sequence. Occasionally, an actor established eye contact but then immediately

looked away from the receiver while scratching its ventrum or an actor stretched and presented its ventrum without scratching. An alternative grooming invitation was leaning forward in front of a potential groomer, sometimes establishing tactile contact, or lying stretched out on the belly (ventrally) either directly in front of the receiver or lying over part of the receiver's body, such as a leg. The draping of an arm over another animal while simultaneously avoiding eye contact could also elicit social grooming bouts and preceded 6% of them. In many instances of social grooming no invitation was apparent. However, with respect to social grooming bouts in which no grooming invitation was observed (23%), the groomer often had approached the receiver from a different area of the enclosure. It might be that in these contexts grooming acted as an appeasement mechanism that allowed an animal to relocate socially with respect to another by reducing the possibility that its presence would elicit an aggressive response.

With respect to tension-reducing grooming it is exceedingly difficult to discuss what constitutes an invitation because in only 3.8% of such bouts was there a grooming solicitation performed in the manner described above. Reference to context is essential because tension-reducing grooming is fundamentally a part of a series of behavioral events in which either the groomer or groomee has been involved. Tension-reducing grooming typically followed aggression, a social or sexual mount, presenting, and/or ventral-ventral embracing (Table 1). It may be interspersed between any sequence of these behavior patterns or any combination of them.

After approaching and tagging the adult male in a sequence interpreted as a confirmation of their age and sex class roles with respect to each other, a young immature male may immediately run to a peer group member and, while vocalizing and grimacing, be groomed by him. Alternatively, the peer group member might mount him first, then, groom him.

It is not always the receiver of aggression that does the grooming. Following an embrace with an aggressor the recipient of the aggression may turn away and, while grunting and grimacing, be groomed by him. These behavioral sequences suggest the possibility that in such contexts the mount, the embrace and similar actions communicate a desire to be groomed (possibly for reassurance). Tension and conflict situations which vary greatly in their intensities and form clearly complicate the discussion of grooming invitations and their functions. Indeed, the possibility exists that particular behaviors such as grooming have multiple functions and, depending upon the specific situation and the specific individuals, multiple meanings. In one context the recipient of aggression may groom to appease the aggressor and to prevent the aggression from continuing while in another context the aggressor may groom the victim, thereby reassuring the recipient that ag-

gression has ceased and that non-aggressive behaviors may be resumed between them.

#### The Relationship Between Grooming and Aggression

To better assess the functional relationship between grooming and aggression among captive langur monkeys, a correlation coefficient which measures the degree or extent of a linear relationship between the two behaviors was computed. By using 500 fifteen-minute focal behavior samples for aggression and 500 fifteen-minute focal behavior samples for grooming, the proportion of times each individual received aggression and acted in grooming was determined first. After computing paired scores for each animal in the group ( $X$ =proportion of times animal A received aggression, and  $Y$ =proportion of times animal A acted in grooming) I entered the data into a Pearson- $r$  correlation matrix. The resulting ( $r$ ) was interpreted in the following way: if ( $r$ ) was negative, it indicated that as grooming increased aggression received decreased and vice-versa; if ( $r$ ) was 0, no linear relationship existed between the two behaviors; and, finally, if ( $r$ ) was positive, grooming increased as aggression increased and vice-versa. Testing to determine if the ( $r$ ) value was significant ( $p < .01$ ), a  $t$ -value was determined and compared with the tabular ( $t$ ) value with  $n-2$  degrees of freedom.

The correlation proved positive ( $r = +4.68$  with a  $t = 2.94$ ). In other words, within the specified confidence intervals it can be expected that when grooming increases between individuals so will aggression. It is interesting to find that, if taken at face value, the commonly held assumption that grooming solidifies relationships, strengthens social bonds and, as a result, decreases the amount of aggression directed toward those who perform it, has proved questionable. Yet, especially in this instance interpreting a cause-and-effect relationship is extremely risky. Clearly, the statistics reveal the importance of considering not simply the numbers, but considering the *contexts* from which the numbers were obtained. The question to be asked is the following. In light of the statistics, which suggest otherwise, can it still be assumed that among the common hanuman langur grooming has a positive, or tension-reducing effect on the group at large?

One must consider several factors. The form of aggression directed by individuals is not made explicit by the correlation. Most aggression was neither tactile nor serious but instead it involved facial, bounce, or hand threats. So too, aggression was often directed in a positive way as, for example, to stop others from fighting, to quell factionalism, and to protect infants from inept substitute caretakers. The adult females performed most of these aggressive policing roles, and since they also were involved in more grooming interactions than any other age and sex class the chances were increased that grooming and aggressive scores would compute linearly. But the most important part

of the question remains, and that is whether grooming behavior is a mechanism that can promote peace by reducing aggressive levels. It is here that an analysis of context shows that in over half of all the aggressive interactions (both tactile and nontactile), grooming immediately followed and was initiated by the receiver of that aggression. That social grooming functions not only to promote bonds and relationships, but also to circumvent continued aggression by one animal to another is suggested by the data. Tension-reducing grooming may not always be successful in preventing aggression but for most members of a society its efficacy is impressive. While grooming typically follows aggression it does not usually precede it (McKenna 1975).

#### Anatomical Focus of Social and Self Grooming

Hanuman langurs groomed all parts of the body. From a sample of 693 social grooming bouts the analysis indicates that those anatomical regions out of sight or reach of a recipient of grooming were more frequently groomed by another animal than were accessible areas. Whereas 55% of the sample involved the grooming of areas designated inaccessible to the recipient of grooming (see Table 2), 45% of the social grooming involved accessible areas. Whether or not social grooming of inaccessible regions promotes hygiene by removing ectoparasites, thereby decreasing possibility of disease, cannot be quantitatively demonstrated but such may be the case. It is important, however, to consider the context of the initiated bout, for the data reveal that the context often determines which part of the body will be groomed. For example, a ventral-dorsal orientation was assumed by a groomer and aggressor, respectively in over 75% of the responses initiated by an attacked animal immediately following attack. Eye contact was either broken altogether, or at least avoided in such incidents, and the social grooming of an inaccessible region of the aggressor's body was initiated by the attacked animal. While this behavior may prove hygienically beneficial in the long run, how it comes about can be explained in terms of the immediate social rewards for each of the participants.

During relaxed social grooming there is, likewise, a tendency to avoid body orientations which require sustained and direct eye contact i.e. a ventral-ventral dyadic orientation. However, as Table 3 reveals, the proportion of times animals are oriented away from each other in a ventral-dorsal position is far less than in the case during tension-reducing grooming (41% versus 69% of the total). At least among captive langur monkeys it can be speculated that the grooming of inaccessible regions of the body appears to be regulated not strictly by hygienic or health needs but by social strategies having immediate social consequences such as suppressing further factionalism and inter-animal aggression.

Anatomical Area		% of Sample Groomed
Inaccessible	Back (Dorsum)	22.2%
	Caudal Area	11.6%
	Underarms (Axilla)	3.6%
	Shoulders	3.2%
	Top of Head	9.3%
	Face-Teeth	5.5%
		T=55.4%
Accessible	Hands	3.1%
	Forearms	8.6%
	Ventral-Thoracic Area	11.6%
	Posterior-Ventral-Abdominal Area	6.0%
	Hindlimbs	4.0%
	Tail (Medial, Distal)	11.3%
		T=44.6%

Table 2. — Anatomical foci of social grooming (n=1,662 receivers of social grooming)

	Relaxed Social Grooming	Tension-Reducing Grooming
Ventral-Ventral Orientation (animals face each other)	44%	23%
Ventral-Dorsal Orientation (receiver of grooming turns away from actor)	41%	69%
Unclear Body Orientation	15%	8%

Table 3. Percent of relaxed and tension-reducing grooming bouts in which different body orientations were assumed by grooming dyads (an actor and receiver).

Anatomical Area	% Groomed
Forearms	29.7
Tails	36.1
Genitals	8.0
Chest (Thoracic Area)	5.0
Lower Abdomen	4.2
Medial Thighs and Hindlimbs	8.0
Hands	3.0
Feet	6.0

Table 4. — Anatomical focus of self-grooming (n=55)

A review of the self-grooming data (Table 4) reveals that during nonsocial grooming sessions animals preferred to groom their tails more often than any other part of their bodies (36% of the sample), while grooming of the forearm followed second in frequency (29%; Figure 3). The fact that tails were most often groomed during solitary grooming sessions is understandable since they were the most vulnerable part of the body. Cuts and lacerations of the distal and medial aspects of the tail were frequently sustained. The animals often caught their tails on parts of the enclosure. Genital self-grooming was most commonly observed among the immature males (6% of the 8% total). It was common for males to sustain an erection during these grooming periods but none were seen to ejaculate.



Figure 3. An adult female grooms herself while simultaneously nursing her infant and sitting-in-contact with her three year old adolescent daughter.

#### Discussion

In Weber's (1973) discussion of tactile communication among free-ranging langurs grooming behavior is described as one of nine "meaningful combinations of communication sequences." While discussing the functions of tactile behaviors including grooming he states, "... in these patterns social needs of bodily contact are articulated and satisfied; they are social expressions of accepting and being accepted" (Weber 1973:481). Similar to the findings here but not altogether in agreement with them Weber found that reciprocal grooming was much more common in "same-sex" subgroups than it was in subgroups containing both sexes and that one-sided grooming by adult females of adult males was typical. He proposed that this one-sidedness of grooming activities occurring between the adults is explained by the fact that "... the interactions between adult males and females in heterosexual groups are always complimentary" (Weber 1973:483). Complimentary interactions are defined in terms of status differentials between the interacting participants. Accordingly, the adult male is always the receiver (i.e. dominant) in grooming interactions and, consequently, does not reciprocate. As actors in grooming interactions the females are always the subordinants. If reciprocal grooming occurs between any two animals, rather than a com-

plimentary relationship, Weber contends that a "symmetrical" relationship can be said to exist between them (Weber 1973:483).

While Weber may be correct in suggesting that actor and receiver roles in particular interactional settings may (at times) reflect dominance and subordination and, thus, are complimentary (his definition), the data collected here suggest that his explanation cannot accurately be applied to all grooming interactions between the adult male and females, nor to many of the other social interactions that occur between them. As was shown earlier, adult and immature males frequently groomed adult females and individual females responded differentially to the grooming solicitations of the adult male. In the event that an adult female ignores a grooming invitation and refuses to groom the adult male (which frequently occurred), using Weber's definition of complementarity the adult female behaves in a dominant (i.e. passive) role with respect to the adult male who, in turn, behaves in the subordinant (i.e. actor) role. The point is that in reference to dyadic situations complementarity is more accurately defined in terms of what the animals are actually doing with respect to each other rather than in terms of status differentials because as a behavioral index the dominance/subordination characterization is often unreliable,



particularly when describing the grooming relationships between male and female adult langurs. So too, females spend much more time grooming each other than they spend grooming adult males so it can be expected that between them much more reciprocity will take place. Furthermore, female-female bonds established and maintained through reciprocal grooming may be more closely tied to the other social roles females perform such as infant caretaking, soliciting sexual behavior, and policing activities rather than a reflection of a general social position they occupy with respect to the males (see McKenna 1975). It is important, therefore, to view grooming behavior not in terms of status differentials but in terms of how this behavior reflects role complexes and interrelated behavior sets that relatively but not absolutely differentiate age groups, sex groups, and age and sex groups combined. By doing so the question of function is best approached because it forces a more comprehensive evaluation of the behavior as it relates to other social and physical needs.

From this more flexible position the positions of Alexander (1974) and Freeland (1976) can be considered. Alexander suggests that in the beginning grooming behavior controlled parasites and only later assumed significant social functions. He states, "That parasite-controlling behavior should acquire a social role only illustrates the effects of group living upon the way selection changes behavior . . . Such relationships between selection and different social functions and effects must be understood if social organization is to be clarified or traced from the beginning" (Alexander 1974: 331). Freeland takes Alexander several steps further when he hypothesizes that troop compositions, infant-caretaking behaviors, sexual behaviors and inter-group relationships are selected specifically to reduce the acquisition of new pathogens and to "minimize the pathogenicity of disease" the individuals of a group might already harbor (Freeland 1976: 12).

While the data on langurs presented here can neither verify nor refute these authors' contentions, they can be useful in assessing the overall feasibility of their arguments. For example, it was shown that langurs tended to groom inaccessible regions of the body rather than accessible regions. This information and the observations made by Curtin (1975) that solitary male langurs during the wet season suffered from leach infestation lends support for the hygienic argument. However, it was also shown that ventral-dorsal body orientations which expose inaccessible areas to others for grooming were governed not only by the immediate social context (relaxed or tense) but also by the nature of the relationship existing between the participants. This point is mentioned to dispel any interpretation which evokes a genetical link between grooming behavior and part of the body groomed.

Probably few investigators will deny that cleaning the fur can be extremely important particularly when animals spend much of their time foraging in litter, swampy areas, or dead wood (Hladik 1975). However, researchers might argue about the utility of deciding which function (social or hygienic) was important first, especially since natural selection does not operate in a vacuum, nor upon one specific behavioral strategy at a time. Instead, natural selection works simultaneously on all the behavioral subsystems which, to greater and lesser degrees, influence the species ability to successfully reproduce. My guess is that structural and physiological adaptations rather than social ones are more likely to have been initially selected for in order to control diseases brought about by ecto-parasites especially since internal parasites which cannot be removed by grooming are just as serious a problem. But it seems useless to speculate in this way since in certain areas parasites and disease can be as much an ecological limiting factor as the availability and distribution of food. Consequently, grooming must be subsumed into a broader context which includes reference to such behavioral subsystems as feeding and ranging patterns, sexual behaviors, rearing practices, predator and incest avoidance, defense strategies and locomotion, all of which gradually emerged in response to environmental pressures.

What is needed to test Alexander's contentions and the sweeping hypothesis proposed by Freeland is a cross-specific comparison of sympatric species that must cope with similar pathogens and disease pressures. In areas of intense parasite infestations grooming ought to be elaborated, at least according to Alexander (1974). If not, a determination of what mechanisms are important in controlling them should be made. Experimental manipulations of groups (relocations of groups from areas with different parasite pressures) could reveal the processes by which such adaptations are made and, perhaps, the role of grooming as a practical vehicle for parasite control. Only after acquiring such data can we accurately assess the etiologies of grooming.

#### Summary and Conclusions

An intensive study of captive Indian langurs (*Presbytis entellus*) revealed that grooming behavior was exhibited more frequently and for greater periods of time than was any other social behavior. Whereas the frequency by which adult females initiated social grooming was much greater than that amount initiated by any other age and sex class, there are important intraclass variations and when individual grooming records are considered, age and sex class distinctions with respect to grooming become less absolute. Characteristically, females groomed for longer periods of time and their grooming networks were much more extensive. Cutting across age and



Figures 4 and 5. Relaxed and reciprocal social grooming is exhibited between these two adult females. In the top photo adult female A (on the right) grooms adult female B (on the left) in a ventral-ventral orientation. In the bottom photo Animal A has turned away from animal B and the grooming roles of the participants are reversed and demonstrate a ventral-dorsal orientation.



sex class boundaries the grooming activities of adult females may function to enhance group integration especially since their grooming activities include immature males whose positions in the group are socially tenuous.

Social grooming solicitations and the contexts in which grooming occurred were tremendously diverse. While the majority of grooming bouts were described as relaxed, tension-reducing grooming which was recognized when one or both of the grooming participants exhibited tense facial expressions or vocalizations occurred after aggressive interactions, before and after social mounts, during sexual and infant-caretaking activities, following social presents and after ventral-ventral embracing. In addition, it was found that although grooming invitations or solicitations were not often a part of a tension-reducing sequence as they were a part of the relaxed social grooming bouts, in the majority of cases it was the receiver of aggression who acted the grooming while the aggressor turned away and received it. The relationship between grooming and aggression proved to be an interesting one since a positive correlation coefficient was computed. As the frequency of grooming increased between individuals so did aggression or vice-versa. The computation of this statistic reveals the value of considering context since rarely (if at all) did aggression follow grooming behavior between participants. In most instances aggression preceded it. Hence, grooming seemed to promote the restoration of peaceful relationships between individuals and the cessation of hostilities. As an appeasement mechanism the grooming behavior of captive langur monkeys cannot be underestimated.

With respect to the strong statements put forth by Freeland (1976), Alexander (1974) and Hutchins and Barash (1976) on the disease-controlling functions of grooming behavior these data can neither prove, nor disprove their contentions. It was, however, stressed that among langurs the part of the anatomy exposed by one animal to another is primarily determined by the nature of the interaction preceding the grooming bout. Inaccessible areas of the body were groomed most often after aggressive encounters. More specifically, ventral-ventral grooming sessions, i.e. grooming interactions that involved the animals facing each other in which eye-contact was sustained, occurred most often during relaxed social grooming bouts. During tense grooming encounters ventral-dorsal body orientations permitting the avoidance of eye-contact between grooming dyads were more common. These facts are relevant to understanding the circumstances in which inaccessible parts of the body are sometimes groomed. While this grooming may function in the long run to decrease disease potentials, the actions of both participants (actor and receiver) provide immediate social rewards; the actor of the aggression is appeased by the attacked animal

attending to it and providing tactile enjoyment while the recipient of aggression and the actor of the grooming manipulates an aggression-receiving situation into a peaceful one.

With the present data in mind some tentative conclusions can be offered. Among Hanuman langurs social grooming is intimately fused with almost all aspects of social life and can be used to manipulate social situations and to establish important social alliances. The argument that grooming originally evolved as a parasite-controlling mechanism appears simplistic and ignores the fact that natural selection works not upon one behavior but on complexes of behavior and makes continuous compromises on the efficacy of each adaptive strategy. The "complimentarity" of grooming behavior as defined by Weber wherein active/passive, dominant/subordinant roles are ascribed to adult male and female langurs is, likewise, unsatisfactory particularly since status differentials are so fluid in langur society. No doubt social grooming performs dualistic social and hygienic functions but given the social base from which colobines evolved it may prove unwise to separate the two, especially since both immediate and long terms benefits are mutually derived.

## REFERENCES CITED

- Alexander, Richard D. 1974 The Evolution of Social Behavior. Annual Review of Ecology and Systematics 5 325-383.
- Altmann, Jeanne 1974 Observational Study of Behavior: Sampling Methods. Behavior 49:227-267.
- Boese, Gilbert K. 1976 Social Behavior and Ecological Considerations of West African Baboons (*Papio papio*). In Socioecology and Psychology of Primates. Russell Tuttle, ed., Mouton: Chicago, Pp. 205-230.
- Chance, Michael, and Clifford Jolly, 1970 Social Groups of Monkeys, Apes and Men. New York: E.P. Dutton.
- Curtin, Richard 1975 Socioecology of the Common Langur, *Presbytus entellus*, in Nepal Himalaya. Ph.D. dissertation, Univ. Calif., Berkeley.
- Freeland, 1976 Pathogens and the Evolution of Primate Sociality. Biotropica 8 (1): 12-24.
- Furuya, Y. 1957 Grooming Behavior in Wild Japanese Monkeys. In Primates, (1): 47-68.
- Hinde, Robert 1974 Biological Basis of Human Social Behavior. New York: McGraw Hill.
- Hladik, C.M. 1975 Ecology, Diet, and Social Patterning in Old and New World Primates. In Socioecology and Psychology of Primates. Russell Tuttle, ed., The Hague: Mouton, Pp. 3-35.
- Hrdy, Sarah 1976 Care and Exploitation of Nonhuman Primate Infants by Conspecifics Other than Mother. In Advances in the Study of Behavior, 6. New York: Academic Press, Pp. 101-158.
- Hutchins, Michael and David Barsh, 1976 Grooming in Primates: Implications for its Utilitarian Function. Primates 17(2): 145-150.
- Jay, P. 1965 The Common Langur of North India. In I. DeVore ed., Primate Behavior. New York: Holt, Rinehart and Winston, Pp. 197-249.
- Kaufman, I.C. and Leonard Rosenblum 1969 The Waning of the Mother-Infant bond in Two Species of Macaque. In B.M. Foss, ed., Determinants of Infant Behavior. IV. London: Mouton, Pp. 41-60.
- Kummer, Hans 1968 Group Techniques of Ecological Adaptations. Chicago: Aldine.
- Lindberg, Charles 1973 Grooming Behavior as a Regulator of Social Interactions in Rhesus Monkeys. In Behavioral Regulators of Behavior in Primates. R. Carpenter, ed., Bucknell University Press.
- McKenna, James 1975 Social Roles and Behavior of Seventeen Captive Hanuman Langur monkeys (*Presbytis entellus*). Ph.D. dissertation, University of Oregon.
- Sade, Donald 1965 Some Aspects of Parent-Offspring and Sibling Relations in a Group of Rhesus Monkeys, with a Discussion of Grooming. Am. J. Phys. Anthropol. 23: 1-18.
- Simonds, Paul 1973 Outcast Males and Social Structure Among Bonnet Macaques (*Macaca radiata*). Am. J. Phys. Anthropol. 38: 599-604.
- 1974 The Social Primates. New York: Harper and Row.
- Sparks, J. 1967 Allogrooming in Primates: A Review. In Primate Ethology, D. Morris, ed., Pp. 148-175. Chicago: Aldine
- Trivers, Robert 1974 Parent-Offspring Conflict. Amer. Zool. 11:219-264.
- Weber, Inge 1973 Tactile Communication Among Free-ranging Langurs. Am. J. Phys. Anthropol. 38:481-486.