

The Brutal Elimination of a Rival Among Captive Male Chimpanzees

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*The relationships among three adult male chimpanzees (*Pan troglodytes*) were observed over a period of 6 years. The males were members of a large, mixed colony of chimpanzees at Arnhem Zoo (Netherlands). In spite of several power takeovers and coalition changes among the males, aggression was restrained during most of the period. This article analyzes a dramatic exception, which occurred after months of instability in the coalition network. At night, the alpha male was attacked and fatally injured in the sleeping quarters. The incident is discussed against the background of the complex balance of power among the males, especially the discrepancy between coalitions serving hierarchical status and coalitions serving sexual competition. Quantitative data support most of the hypotheses.*

INTRODUCTION

After a fight in a night cage housing three adult male chimpanzees, one male was fatally injured. If this incident had been reported, one decade ago it might have been discarded as "unnatural" (that is, caused by crowding and stress), leaving the then prevailing peace-loving, Rousseauian picture of great apes intact. Nowadays, the incident fits a pattern of sobering discoveries of extreme violence and cannibalism among apes in their natural habitats (Goodall 1979; Goodall et al. 1979; Fossey 1981, 1983; Nishida et al. 1979; Nishida et al. 1985).

The adult males involved in the fight were members of the world's largest captive colony of chimpanzees kept, since 1971, at Arnhem Zoo. (Netherlands). Four adult males, nine adult females, and a growing number of immatures (at least 10 during the reported period) lived on an island of nearly 1 hectare during 8 months of the year, and in a heated hall during the

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winter. The incident occurred in the fall of 1980, after years of peaceful coexistence between the same individuals under the same conditions. Actually, the colony has provided a mass of data on reconciliation behavior and other forms of tension regulation (de Waal and van Roosmalen 1979; de Waal 1982, in press). These studies have shown that adult males are especially active in buffering antagonism, e.g., males involved in a status struggle groom each other much more than usual. Although the incident described below demonstrates that such buffering mechanisms are not infallible, they suggest at the same time that their existence is no luxury.

Developments earlier than 1980 are discussed in an attempt to trace the causes of the violence. As it seems, the act had much in common with what, in humans, would be called "political murder." The picture emerging can only be fully appreciated after reading the detailed account of the group's history over preceding years, 1975-1979, provided elsewhere (de Waal 1982). A synopsis of this history follows below.

SUMMARY OF PRECEDING YEARS

Dominance among chimpanzees is measured by a particular vocalization known as "pantgrunting" or "rapid ohoh." While uttering these sounds, the subordinate lowers his or her body and looks up at the dominant. This behavior has the unique characteristic of occurring between any two individuals in one direction only (Bygott 1974; Noe et al., 1980), in sharp contrast to other dominance indicators, such as competitive priority and aggression, which show many inconsistencies. For this reason, submissive pantgrunting is regarded here as an indicator of *formal* rank (de Waal 1982).

In the beginning the alpha position in the Arnheim colony was occupied by the oldest male, Yeroen. When, in the summer of 1976, the second male, Luit, ceased to show submission to Yeroen and began to challenge him by means of noisy intimidation displays, all adult females were observed to help Yeroen defend his position. Luit, on the other hand, received support against the females from the third male, the much younger Nikkie. Since Nikkie supported Luit against Yeroen's supporters only, never directly against Yeroen himself, I have called this an "open" coalition. After several months Yeroen submitted to Luit, and later to Nikkie as well.

The new alpha male, Luit, competed every day with his former coalition partner, Nikkie, over access to the fallen leader. Both of them tried to sit and groom with him, and to prevent the other from doing so. After about 1 year, Yeroen and Nikkie formed a "closed" coalition against Luit. By then, Luit had gained the loyalty of almost all females, giving him a strong position. In subsequent months it proved to be insecure against the fighting power of two males, however. His fate is reminiscent of the balance of power paradox "strength is weakness." This means that the strongest of three competing parties almost automatically elicits cooperation against himself, because the

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weaker parties gain more by joining together and sharing the payoffs than by joining the strongest party, who will try to monopolize the payoffs. Thus, Nikkie was made alpha male by Yeroen's support and depended completely on him.

Our continuing observations indicated a growth in strength of Nikkie's position over the years. In connection with the present account, the most important development was a dramatic change in Nikkie's relationship with

(See associated.pdf file)

FIGURE 1. Overview of male coalitions affecting formal status (left) and coalitions affecting sexual competition (right). Yeroen had a mating monopoly until, in 1976, he was challenged by the "open" Luit-Nikkie coalition. In spite of massive female support, Yeroen lost this alpha position to Luit. In 1977, Luit's alpha period came to an end when Yeroen and Nikkie formed a "closed" coalition against him. Also, Luit received female support. In sexual contexts Yeroen formed a double coalition, playing off the two other males against each other. This paid off in terms of mating frequency for Yeroen (Fig. 3). The situation changed when, in 1978, Nikkie became dominant and Luit's support for Yeroen ceased. As alpha male, Nikkie did not have female support; consequently, he depended completely on Yeroen. In the sexual context Nikkie began moving away from his coalition partner towards the old "open" coalition with Luit. The growing discrepancy between status-related and sex-related coalitions is regarded here as the source of the outbreak of violence.

Luit during periods of sexual competition. Initially, Yeroen had been able to claim access to estrous females by enlisting Luit's support if Nikkie approached the female, and enlisting Nikkie's support if Luit approached her. This changing of sides gave Yeroen a powerful key position. A similar strategy by an older, subordinate male has been observed by Nishida (1983) in the wild.

Yeroen's success decreased by the end of 1978 when both other males suddenly refrained from supporting him against each other. I have interpreted this as a "nonintervention treaty" between Luit and Nikkie. This special relationship, only manifest during periods of sexual competition, developed further over the years. Figure 1 summarizes the changes in the males' coalitions during 1976-1979.

GROWING TENSIONS

The logbook for 1980 opens by noting that this was the first winter that the colony was spending in almost perfect harmony. Whereas aggression levels had been relatively high during previous winters (Nieuwenhuijsen and de Waal 1982), this time the chimpanzees seemed remarkably calm and relaxed. The situation within the male triangle was stable, the coalition of Nikkie and Yeroen against Luit being as strong as ever. The two ruling males frequently separated Luit from high-ranking females, thus preventing contacts that in the long run might strengthen Luit's position in the group. The dominance relationship between the two oldest males, Yeroen and Luit, remained unclear, as it had been since Nikkie became an alpha male.

The first few months in the outdoor enclosure were relaxed as well. One of the adult females, Krom, began cycling, but her first two estrous periods did not lead to much competition among the males. During one of the first days of Krom's third estrous period, however, we observed a fight that may be crucial for the understanding of the subsequent events. On the morning of July 4th, there was an indication of the "open" coalition between Nikkie and Luit known from periods of sexual competition in previous years (as indicated above). When Yeroen sexually invited Krom, the other two males approached him with their hair on end. Yeroen left the female, but pushed Nikkie and hit Luit. Then all three males screamed and Nikkie and Luit mounted each other.

Hours later, the three males were sitting under a tree with Krom in it. When Luit started to climb towards her, Yeroen yelped and looked alternately at Luit and Nikkie. Luit returned to the ground and approached the others. The three males hooted in chorus. After a few minutes, however, Luit went into the tree again. Now Yeroen burst out in loud screaming against Luit while holding out his hand for support to Nikkie. But Nikkie walked away from the scene. Yeroen responded by making a surprise attack on Nikkie, jumping on him from behind and biting him in the back. The

conflict became more complex because some females supported Yeroen, the fourth-ranking male defended Nikkie, and one female chased Krom out of the tree. The most important observation, however, was Yeroen's immediate violent reaction to Nikkie's refusal to keep Luit from approaching the attractive female.

END OF THE COALITION

The First Serious Fight

On July 6th, 2 days after the above incident, an unobserved fight took place in the night cage of the three males. In view of the injuries found on two of the males, this must have been the worst inter-male fighting since the establishment of the Arnhem colony. Nikkie showed deep injuries on the tips of many fingers and toes, as well as on his bottom and ear. Also, Yeroen's fingers and toes were bitten and swollen; he was missing several nails and the tip of one toe. Luit, in contrast, only showed one superficial scratch. Male fighting does not usually result in injuries, but if it does these are almost invariably found on hands and feet. It was, therefore, not the location of the injuries but their number that made this fight exceptional. In addition, none of four males had ever before lost part of a finger or toe.

Although no winner or loser could be determined on the basis of a mere injury count, Nikkie clearly behaved as the loser. Whereas he had been a very impressive, big alpha male up to that night, he now looked unrecognizably small, depressed and pitiful. Even though it did not seem as if Luit had been very much involved in the physical battle, he emerged as the new dominant male. Although this development is hard to understand in dyadic terms, its explanation is simple considering the triadic structure. Previous years had provided plenty of evidence that Yeroen and Nikkie needed each other's support in order to be able to keep Luit in check. It was, therefore, to be expected that Luit would regain control as soon as the coalition collapsed. This interpretation of the night cage fight as the end of the ruling coalition is supported by subsequent observations and by data presented in the Quantitative Data section.

The only alternative reconstruction of the events is that Luit had single handedly injured and defeated both other males. Yet, as also confirmed by subsequent events, such a feat must be considered as beyond Luit's physical abilities.

Management Decisions

The four adult males of our colony had been kept together in two interconnected night cages since May, 1978. The fourth male, Dandy, was more or less given the choice. During some periods he slept with the other males,

and during other periods he preferred to sleep apart (as he did during the entire period described in this article). After the fight between Yeroen and Nikkie we decided to keep the three males out of the group for 1 week and to put them together only when supervision was available. All this went well; the three males spent the days in one of the indoor halls and the nights in separate cages. After this week they were reintroduced into the group. At night we still kept them apart.

In the course of a few weeks, however, it became increasingly difficult for the keeper to separate the males at night. Yeroen always tried to enter together with Nikkie in a single cage. If he succeeded, Luit became very excited, refused to go into his cage, and occasionally even attacked the keeper through the bars. If, on the other hand, Luit and Nikkie happened to enter a cage together, Yeroen showed the same response. It seemed that neither Luit nor Yeroen wanted to be left out if the other two males managed to get together.

After approximately 7 weeks we decided to leave the matter of separation up to the males themselves. If they strongly wanted to be together they were allowed to. Otherwise they were kept apart. This decision relieved the keeper from the stressful and time-consuming job of separating the males, which sometimes took her until late in the evening. At the time, I held the philosophy that chimpanzees are better at estimating the possibilities within their own relationships than we, human observers, are. And maybe this is still true. The unfortunate consequence of the males' desire to spend the nights together, and of our decision to let them, does not necessarily mean that they were unaware of the dangers.

Testing Out New Coalitions

During the entire 10-week period between the first and second serious fight, Nikkie behaved extremely submissively towards Luit, sometimes literally groveling in the dust for him. Yeroen showed much less submissiveness, and often counterdisplayed if Luit approached him with erect hair and dominant posture. Yet even Yeroen's rare soft pantgrunts to Luit represented a big change as compared to their previous relationship, which had lacked any formal indication of dominance.

Among the adult males there remained many signs of tension and instability. Since their relationships kept changing, it is difficult to summarize them. One day we might note in the diary that Luit seemed to be forming a coalition with Dandy (the fourth-ranking male, who had suddenly become more active); the next day we might see Luit and Nikkie make a joint intimidation display in large circles around the other two males, who screamed in panic, and we would predict a Luit-Nikkie coalition for the future. The best way to summarize, if I feel, is by saying that the males seemed to be trying out all supportive combinations among themselves, except for the Yeroen-Luit combination. For Yeroen, restoration of the coalition with Nik

Nikkie seemed to have priority over any other possible options. Yeroen would scream in apparent frustration and follow Luit and Nikkie around whenever they walked together. And Yeroen himself often tried to sit and groom with Nikkie.

Both Krom and another adult female, Spin, came into estrus during the period. Nikkie usually did not dare to approach these females, and mated a few times with adolescent females instead. Yeroen and Luit regularly made sexual advances to the two adult estrous females, but these seemed less responsive than usual. We recorded 19 matings, of which Luit performed only 1. Luit's lack of complete dominance over Yeroen, and his possible insecurity about potential coalitions against himself, may have inhibited his mating activity. Luit gave an impression of great nervousness during the second half of this period.

THE FATAL FIGHT

During the night of 12 -13 September, the males' nightcages turned red with blood. Apparently, the males had already reconciled when we arrived in the morning; they were relatively calm and the keeper had trouble separating them. Luit made great efforts to stay with the other males, which is quite remarkable in view of what they had done to him.

Luit showed numerous deep gashes on head, flanks, back, around the anus, and in the scrotum. His feet, in particular, were badly injured (from one foot one toe was missing, from the other foot, several toes). He also had sustained bites in his hands (several nails were missing). The most gruesome discovery was that he had lost both testicles. All missing body parts were later found on the cage floor.

Closer inspection, on the operating table, of Luit's scrotal sac revealed that, contrary to our expectation, it had not been ripped widely open. Instead, we found a number of small holes. The cuts through the skin were between 1 and 3 cm in length and almost certainly, just like most other injuries, caused by canines. It was unclear how the testicles had come out. (See the appendix for other examples of scrotal injuries in primate mates.)

For 3^{1/2} hours the zoo's vet, Piet de Jong, and his assistant, Hans Roest, worked to save Luit's life. They cleaned his wounds and must have placed between 100 and 200 stitches. In the evening, however, Luit died in his nightcage, still partly under narcosis from a low dose of Sernylan (0.5 mg/kg). The main reason for his death may have been the combination of stress and loss of blood. By that time the rest of the colony had entered the sleeping quarters. The group was completely silent during the time that Luit's body was lying in his cage. Also, the following morning, even at feeding time, hardly any sounds were heard. Vocal activity resumed only after the corpse had been carried out of the building.

For a reconstruction of the second nightcage fight it is important to

know that Luit was the only male with serious injuries. Nikkie did not show any damage at all, whereas Yeroen had small scratches and cuts. His injuries, though large in number, were superficial. Since Luit was a strong mate, definitely stronger than Yeroen and at least of the same strength as Nikkie, the remarkably unequal outcome of the fight is explainable, in my opinion, only by assuming a high degree of collaboration between Nikkie and Yeroen. Perhaps one mate held Luit firmly from behind while the other attacked and bit him from the front.

An alternative explanation, suggested to me during a presentation of the case to a group of veterinarians, is that the other males had made a surprise attack on Luit while he was asleep. A heavy blow or bite in the testicles might have paralyzed him for a while, during which time it might have been relatively easy to attack him further. The question, however, is whether paralysis through pain would have lasted long enough. Blood was smeared and spattered all over the floor, walls, bars, and even the wire roof, suggesting a protracted struggle with a great deal of chasing and escape attempts. Seeing the damage done to Luit and the mess in the cage, I would guess that the battle must have lasted for over 15 minutes, and that Luit must have been far from immobilized.

ANEW TRIANGLE

On the morning of September 13, after Luit had been isolated for treatment, were released Nikkie and Yeroen into the group. The first thing that happened was an unusually fierce attack by a high-ranking female, Puist, on Nikkie. She was so persistently aggressive that Nikkie fled into a tree. On her own Puist kept Nikkie there for at least 10 minutes by screaming and charging each time he tried to come down. Puist had always been Luit's main ally among the females.

Later on in the day, the group showed great interest in the two mates, grooming them and inspecting them. From this day Dandy started to play a much more important role than ever before. He repeatedly sought contact with Yeroen, and resisted separation attempts by Nikkie. In the course of subsequent months tensions in the new male triangle calmed down, however. On October 14th Yeroen uttered his first submissive pant grunts to Nikkie since their night fight of July 6th. After a period, in the fall of 1980, with unusually high frequencies of contact and grooming, the relationship between Yeroen and Nikkie became similar to the one they had had before, with Dandy now in the position of their common rival.

QUANTITATIVE DATA

Assisted by a changing team of doctoral students, systematic data were collected on all kinds of aspects of colony life. Below follows some results relating to the described outbreak of violence.

One student, Fred Ruoff, observed adult males over the outdoor period of 1979. His study confirmed the pictures sketched in de Waal (1982), and also represented in Figure I, namely, that of dramatic changes in the Luit-Nikkie relationship when estrous females were present in the colony. Normally, when two of the three top males gave a joint aggressive or intimidation display, the most common team was that of coalition partners Yeroen and Nikkie, and the rarest combination that between Luit and Nikkie, [66% and .14%, respectively ($N = 11$)]. With one or several females in estrous, on the other hand, the Luit-Nikkie combination was responsible for 30% of... joint male display ($N = 107$), which was a significant increase (χ^2 test, two-tailed $p < 0.01$). Ruoff's data also show that only the Luit-Nikkie relationship changed its ratio between positive contacts and aggressive encounters. During periods with estrous females their ratio became more positive (χ^2 test, two-tailed $p < 0.001$) due to both increased contact and decreased conflict frequencies. These analyses support the interpretation that Nikkie, as alpha male, formed an "open" coalition with Luit during periods of sexual competition.

Figure 2 provides 6 years of data on the Yeroen-Nikkie relationship. These data serve to test the hypothesis that Luit, in 1980, became an alpha male by default, that is, his sudden rise in status was due to a break in the ruling coalition. The parameters used to measure the strength of the coalition between Yeroen and Nikkie are, from top to bottom.

Intervention tendency. Intervention is defined as aggressive interference with a conflict between others (de Waal 1978). Figure 2 expresses interventions of Yeroen and Nikkie in each other's conflicts as a percentage of the total number of interventions by both males. In the months before their big fight, in 1980, they had reached a level of 55%, indicating how very much each male was oriented toward his partner's aggressive encounters with others in the colony.

Support attitude. Interventions could be in favor or against the other male. The index used here is the difference between pro and contra interventions divided by their sum: $(\text{pro} - \text{con}) / (\text{pro} + \text{con})$. This index can range between +1 (total support) and -1 (totally contra). Yeroen and Nikkie reached a low point in 1978 when they, while maintaining their coalition against Luit, disagreed about who would dominate the coalition (de Waal 1982). Before their big fight, in 1980, they had reached a very positive level of 0.67.

Percent association. This is the proportion of samples, taken every 5 minutes, during which the two males sat within 2 meters from one another. In the beginning of 1980 Yeroen and Nikkie spent 53% of their time in association, which is an exceptionally high rate, on the order of associations between mothers and juvenile offspring.

Tests were applied to verify whether the Yeroen-Nikkie coalition had changed after their fight in the night cage. All three measures dropped, two

(See associated.pdf file)

FIGURE 2. Intervention tendency, support attitude, and percent association for the Yeroen and Nikkie coalition over the years. See the text for definitions. The period in the middle of 1980 is that of Luit's leadership after the fight between Yeroen and Nikkie, and before Luit's death.

significantly support attitude, one-tailed $p < 0.05$; association time, one-tailed $p < 0.01$. As can be gathered from Figure 2, the coalition was not broken up completely, only weakened, and after Luit's death it soon regained its previous strength. The enormous peak of 84% association between the two males, in the fall of 1980, which was accompanied by a high grooming activity, must be seen as a process of repairing the disturbed relationship.

Figure 3 shows the distribution over the four adult males of completed matings with estrous females. Had matings been divided equally, each male would have contributed 25% to the total. The periods shown are Nikkie's first year as alpha male (1978), his second year (1979 and beginning of 1980), Luit's brief alpha period, and Nikkie's third year (fall 1980 and first half of 1981). The graph is based on 234 observed matings.

The distribution of matings during Nikkie's second alpha year was sig -

(See associated.pdf file)

FIGURE 3. Distribution of mating activity over the four adult males. For explanation see text.

nificantly different from that during his first year (X^2 test, two-tailed $p < 0.01$). Whereas Yeroen had been mating nearly twice as frequently as both Nikkie and Luit, he was in the second year surpassed not only by alpha male, Nikkie but also by his rival, Luit. These data demonstrate that the "open" Luit-Nikkie coalition was to Yeroen's disadvantage.

The remainder of Figure 3 illustrates the already mentioned low mating frequency of Luit in the months before his death, and the near monopoly of Nikkie afterwards. Dandy's mating activity increased sharply during the period of Luit's leadership, mainly because the constant tensions among the ...three dominant males made it easier for him to arrange "rendezvous" with females behind trees and rocks in the large outdoor enclosure.

Figure 4 concerns submissive greeting behavior towards adult males. This behavior is the chimpanzee's formal rank signal, as explained in the second section. Rank reversals among the males, determined on the basis

(See associated.pdf file)

FIGURE 4. Dominance rank among the three top males as determined by submissive greeting (pant grunts) by one male to another (top). Proportion of submissive greetings by the rest of the colony members received by each of the males (bottom).

of male -male greetings, are illustrated at the top of Figure 4. The bottom part shows the proportion of greetings by nonmales, that is, by females and immatures, directed to males. Figure 4 shows that the correlation between the amount of greeting received by a male and his status in the male hierarchy is imperfect. Except for the period in 1976 -1977 when Luit was alpha male, Yeroen received most of the greetings. Although Nikkie dominated Yeroen since 1977, winning most of his conflicts with Yeroen and being greeted by him, Nikkie never received the same amount of respect from females as Yeroen did.

Female greetings may be read as a litmus test of male power and authority. The history of the colony (deWaal 1982), and also the events presently reported, indicate that Yeroen has for many years been the most influential male in the colony, even after losing his formal rank. He remained the key figure in the coalition network, and behind the scenes kept ruling the group. Interpret Figure 4 as evidence that the female population shared this view of Yeroen.

Figure 4 also shows that the break in their coalition affected Nikkie's but not Yeroen's receipt of female respect. After Luit's death, however, Nikkie regained his former share and began to come very close to Yeroen's.

CONCLUSION

Under free-ranging conditions a male such as Luit, suddenly finding himself in a very insecure position, might avoid other males. Peripheralization or disappearance of males in connection with intragroup tensions has been reported by Riss and Goodall (1977) and Nishida (1983). Living at the border of the territory may be dangerous, however, because of the increased risk of being attacked by neighboring males, whereas leaving the group altogether is perhaps not a realistic option for female chimpanzees. They seem more or less captives of their own group. Kawanaka (1984) discusses peripheralization as a form of ostracism, therefore, and calls it "going into exile."

The outbreak of violence in the Arnhem chimpanzee colony cannot be explained by simple concepts such as stress and crowding. The night cages are admittedly small, but the males had slept nearly 800 nights in the same situation without fights. In addition, they were not obliged to sleep together in a single cage. I would rather say that the housing conditions, in combination with the males' desire to stick together, had created an *opportunity*. It did make the fatal attack possible, but does not explain why it happened.

The observations indicate that quite sophisticated social processes may underlie at least the first big fight, that is, the one between the two members of the ruling coalition. By bringing Nikkie to alpha rank, Yeroen had regained both the group's respect and a good share of the sexual activity. I tend to regard this as a "deal," whose fulfillment was closely monitored by Yeroen. When Nikkie failed to keep his end of the deal, starting to lean more and more towards Luit in the sexual context, Yeroen simply ended the coalition.

The resulting power vacuum was immediately filled. Luit was the first male to become alpha overnight, apparently without conquering the position. He seemed very uncomfortable, however, perhaps realizing from previous experience that his strength was also his weakness. There is no way of knowing whether the attack on Luit was a purposeful act of trying to "solve the problem" by eliminating a rival, or an act of blind frustration by Yeroen and Nikkie due to the sudden loss of status after the break in their coalition, or something else. The fact is, though, that it did solve their problem.

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APPENDIX

Castration, though definitely not a common type of injury, may be a risk with which primate males should always reckon. From colleagues I have heard of a dozen of cases of scrotal injuries both in chimpanzees and other primates. Unfortunately, it was not possible to obtain written confirmation of all cases. Below follow seven confirmed instances:

I. In the Masai Mara reserve (Kenya) an adult male baboon (*Papio anubis*) was hit with a tranquilizer dart. Other males responded to the sound of

the dart pistol and ran over to the scene, where the subject had started to act drowsy. One male attacked him, aiming at the groin, making a deep canine gash, missing the scrotum by a fraction. The attacker was chased off by people. The groin injury was the only one sustained. After healing of this wound, the subject, a recent immigrant to the troop, soon rose to alpha status (Barbara Smuts, personal communication).

2. An almost identical case is described for a baboon male (*Papio ursinus*) in the Okavango Swamp, Botswana: recent immigrant, hit with a tranquilizer dart; severely bitten in thigh close to scrotum; after healing he became alpha male in the same troop (Curt Busse, personal communication).

3. In a captive group of Java macaques (*Macaca fascicularis*) other males made a gang attack on the new alpha male. He suffered large scrotal injuries, but recovered. The male maintained his rank (Christian Welker, personal communication).

4. In another captive group of the same species, the second rank male was attacked by one male from the front, another male behind. He lost one testicle in the fight (described in de Waal 1977, p. 248).

5. In the Asarori Forest (India) an adult male rhesus macaque (*Macaca mulatta*) was found after a long-lasting attack by four other males. The victim died. One of his major wounds was a deep laceration in a testicle (Lindburg 1971, p. 74).

6. Some of the fights between male chimpanzees (*Pan troglodytes*) of different communities in Gombe were observed, and it has been noted that the aggressors seemed intent on killing their victims. One of the victims, adult male De, was met in the forest 1 month after the attack on him; "His once large scrotum had shrunk to a fifth of its former size" (Goodall et al. 1979, p. 38). He was never seen again.

7. Kano (1984) describes physical abnormalities in wild bonobos (*Pan paniscus*), closer relatives of the chimpanzee, in Wamba, Zaire. Three adult males were seen lacking both testicles. Injury during an agonistic encounter is suggested as a possible cause for one of these emasculated males.