Self-Biting in Caged Macaques: Cause, Effect, and Treatment

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Injurious self-biting is one of the most serious problems in primate colonies (Niemeyer, Gray, & Stephen, 1996). “Approximately 10% of captive, individually-housed monkeys engage in the disturbing phenomenon of self-injurious behavior (SIB). To date, no adequate explanation or effective therapy has been developed for this disorder” (Jorgensen, Novak, Kinsey, Tiefenbacher, & Meyer, 1996; cf. Novak, Kinsey, Jorgensen, & Hazen, 1998). In rhesus macaques—the predominant species found in laboratories—the incidence of self-biting may be as high as 14% (recorded in a colony of 188 single-caged males; Jorgensen, Kinsey, & Novak, 1998). Individuals affected with this “behavioral pathology” (Erwin & Deni, 1979, p. 4) repeatedly bite parts of their own bodies (see Figure 1) while intermittently showing signs of intense excitation such as threatening, trembling, head jerking, and piloerection (Reinhardt, 1999; Tinklepaugh, 1928).

CAUSE

There is no discernible influence of rearing history on the development of self-biting (Bayne, Haines, Dexter, Woodman, & Evans, 1995). Although self-biting is rather common in primates reared in isolation (Sackett, 1986), it is by no means restricted to animals with impoverished early experience (Bayne et al., 1995; Erwin, Mitchell, & Maple, 1973).
The behavior pattern typically occurs in emotionally disturbing situations over which the subject has no control (Anderson & Chamove, 1981; Erwin et al., 1973; Gluck & Sackett, 1974; Tinklepaugh, 1928). Separation of affectionate companions (Chamove, Anderson, & Nash, 1984; Redican & Mitchell, 1973), separation of sexual partners (Erwin et al., 1973), excessive disruption of daily routines such as cage transfers (Jorgensen et al., 1998), presence of fear-inducing personnel (Allyn, Deyme, & Begue, 1976; Berkson, 1968; Fittinghoff, Lindburg, Gomber, & Mitchell, 1974; Pond, & Rush, 1983; Reinhardt, 1999), or simply being confined alone in a cage can be such distressing experiences that they prompt self-biting behavior. The National Research Council (1998) warned that “prolonged individual housing is probably an influential contributing factor [of] severe self-directed biting” (p. 34) and therefore recommends that every effort should be made to house the animals socially rather than individually. This is in line with a fundamental rule of good animal husbandry: “Animals should be housed with the goal of maximizing species-specific behaviors and minimizing stress-induced behavior. For social species, this normally requires housing in compatible pairs or groups” (National Research Council, 1996, p. 22).

**EFFECT**

Self-biting often goes unnoticed because subjects most of the time do not break the skin while biting themselves (Reinhardt & Reinhardt, 2001). In a case study (Reinhardt, 1999) of seven rhesus macaques, self-biting was associated with no
visible wound in 43% (3/7) of cases, with abrasion(s) in 28.5% (2/7) of cases and lacerations in 28.5% (2/7) of cases. Lacerations often require veterinary attention, and “research has shown that approximately 10% of captive, individually housed monkeys have had some veterinary record of self-injurious behavior in their life-time” (Jorgensen et al., 1998, p. 187; Platt, Kinsey, Jorgensen, & Novak, 1996). Self-biting may occur with sufficient vigor to break bones (Sackett, 1986), and the self-inflicted wound(s) can be so severe that surgery is needed to save the limb (see Figure 2).

TREATMENT

Distracting three individually housed rhesus macaques with a food delivering apparatus reduced the incidence of motor stereotypes but not of self-biting behavior (Preilowski, Reger, & Engele, 1988). In another study with two rhesus macaques, self-biting declined in frequency, whereas motor stereotypes increased in the presence of a foraging apparatus (Watson, 1992). Obviously, “the ability of environmental enrichment devices to ameliorate self-aggressive behavior in laboratory primates is unclear” (Watson, Cosby, & Lee-Parritz, 1993, p. 356).

In a more representative investigation with nine single-caged rhesus macaques, it was found that access to puzzle feeders or grooming boards had no effect on self-injurious biting even though all animals used the gadgets as intended (Kinsey, Jorgensen, & Novak, 1997; Kinsey, Jorgensen, Platt, & Hazen, 1996). In fact, some monkeys got so excited while extracting peanuts from the puzzle that they actually bit themselves (Novak et al., 1998). These findings lead to the conclusion

![Figure 2](image.png)

**FIGURE 2** Individually caged male rhesus with self-inflicted bite injury requiring veterinary attention.
that self-injurious biting “cannot be remediated through simple environmental changes alone” (Kinsey et al., 1997, p. 123).

Weekly treatment with cyproterone acetate—an antiandrogen—reduced the incidence of self-injurious behavior in eight singly housed rhesus macaques (Eaton et al., 1999). The twice-daily oral administration of guanfacine—an alpha2 receptor agonist—halted self-biting in two animals. Discontinuation of treatment, however, resulted in a reoccurrence of this behavior pathology (Macy, Beattie, Morgenstern, & Arnstern, 1999). Clinical assessment suggested that guanfacine decreased the high level of emotional arousal that commonly accompanies self-biting.

In a behavioral assessment of adult female long-tailed macaques, “self-abusive behaviors [self-biting, self-hitting, hair pulling] were recorded in five out of ten subjects when singly housed, but were completely absent after pair formation” (Line, Morgan, Markowitz, Roberts, & Riddell, 1990, p. 4). The therapeutic effect of a social companion is also confirmed in rhesus macaques. Qualitative observations of juveniles suggested that self-biting was noticeably reduced in animals who were transferred from single- to pair-housing conditions (Bushong, Schapiro, & Bloomsmith, 1992). These findings were confirmed in a quantitative study of seven adults: three females and four males (Reinhardt, 1999). Transfer from single housing to compatible same-sex, pair-housing arrangements had a therapeutic effect on pathological self-biting behavior in each of the seven animals.

The conspicuous excitation and self-biting in the presence of personnel was abandoned immediately on the day of pair formation in three animals or gradually within the next two months in the four others. The behavior pattern was no longer witnessed thereafter over a follow-up period of one year or longer. (Reinhardt, 1999, p. 4)

In two additional cases, one adult female and one adult male rhesus were cured from self-biting by permanently pairing each of them with a naturally weaned infant (Reinhardt, Houser, Eisele, & Champoux, 1987; see Figure 3).

DISCUSSION

Self-biting is the most serious behavioral pathology in captive macaques. The strikingly high level of emotional excitation, along with the self-inflicted physical trauma, suggests that the self-biting animal is reacting to a distressing situation. Because self-biting typically occurs in individually caged—rather than group-housed—animals, the social deprivation associated with single-caged housing is probably the primary, constantly active factor for the manifestation of this behavioral problem. Being confined in a single-cage without option to meet one of the basic requirements for well-being, namely companionship, is an extremely disturbing situation for nonhuman primates. It has been demonstrated in
macaques that individual caging may constitute such a potent stressor as to produce immunosuppression (Lilly, Mehlman, & Higley, 1999; Line, Shively, Hiese, Robin, & Cohen, 1993; Schapiro, Nehete, Perlman, & Sastry, 2000), increase the susceptibility to diarrhea (Schapiro & Bushong, 1994), and promote the development of coronary atherosclerosis (Shively, Clarkson, & Kaplan, 1989). It should be remembered that self-injurious behavior also is shown in human primates who are kept in solitary cells, and “these ‘cages’ are so terrible that many prisoners prefer to maim themselves rather than stay there” (Yaroshevsky, 1975, p. 445). Regardless of these intrinsic problems, “single or individual caging systems are the basic or staple housing used for primates” (Rosenberg & Kesel, 1994, p. 459), and macaques in particular (National Research Council, 1998), in research laboratories.

In the United States, there are an estimated 15,000 individually caged macaques. If 10% of these animals exhibit visible injuries resulting from self-biting and another 10% show unnoticed self-biting behavior, then about 3,000 animals (20%) are affected by this gross behavioral pathology. It stands to reason to assume that these 3,000 individuals have no scientific value because research data collected from them are confounded by the animals’ high emotional disturbance.

FIGURE 3 Rhesus male Bruce used to get hyperaggressive and engage in self-injurious biting when approached by personnel (note the healed wound on the right arm). Being paired with an infant cured him from this behavioral pathology.
and hence cannot be considered scientifically valid (American Medical Association, 1992; Fuchs, 1997; Novak & Bayne, 1991; Russell & Burch, 1959; Woolley, 1997). The secondary pathophysiological effect of self-biting may also interfere with any scientific investigation.

The seriousness of self-biting is highlighted by the fact that this behavioral syndrome, unlike other disorders, is resistant to occupational therapy attempts (National Research Council, 1998). A foraging device, a grooming board, or a toy will not cure a monkey of self-biting. Even though medical treatment is not a cure, it may at least halt self-biting, thus providing time to correct extraneous stressors that trigger this behavior. The principal stressor is obviously the absence of a companion. Moreover, in primates, as in most other social animals, the presence of a compatible social partner acts as a powerful buffer against extraneous stress (Bovard, 1959; Coe, Franklin, Smith, & Levine, 1982; Coelho, Carey, & Shade, 1991; Epley, 1974; Gust, Gordon, Brodie, & McClure, 1994; Mason, 1960). It is therefore not surprising that the transfer from solitary confinement to pair-housing arrangements is a reliable cure of self-biting behavior in macaques—and probably in other primate species. The social companion meets a constant need and therefore provides a lasting cure. Other environmental enrichment options may distract an animal sufficiently to inhibit self-biting. However, this effect will always come to an end once the animal has satisfied his or her appetite in food treats delivered by the foraging device or has lost interest in the grooming board or in the toy.

There are a number of practical and safe options of transferring single-caged, long-tailed macaques (Lynch, 1998), pig-tailed macaques (Byrum & St. Claire, 1998), stump-tailed macaques (Reinhardt, 1994b), and rhesus macaques (Reinhardt, 1994a)—including social isolates (Reinhardt, 1990)—to compatible pair-housing arrangements without affecting the animals’ stress status and health (Eaton, Kelley, Axthelm, Iliff-Sizemore, & Shiigi, 1994; Reinhardt, Cowley, & Eisele, 1991; Reinhardt & Hurwitz, 1993; Schapiro, Bloomsmith, Kessel, & Shively, 1993; Schapiro & Bushong, 1994) and without interfering with husbandry practices and common research protocols (Reinhardt & Dodsworth, 1989; Reinhardt, Houser, & Eisele, 1989; Reinhardt & Reinhardt, 2001). These options will have to be implemented on a much more consistent basis not only to address the social needs of nonhuman primates in accordance with current federal law (United States Department of Agriculture, 1991, p. 6499) but also to deal with the ethically and scientifically unacceptable problems of self-biting behavior.

The transfer of a self-biting subject to compatible group-housing arrangements is similarly effective as the transfer to pair housing (Reinhardt’s unpublished observation; cf. Bayne, Dexter, & Suomi, 1991; Hartner et al., 2000; Missakian, 1972). However, under the constraints of the research laboratory, it may be difficult to provide the necessary management conditions that will make the group integration successful. Moreover, it also has to be assured that living in a group will
indeed be less stressful for the subject than living alone (Bernstein, Gordon, & Rose, 1974; Bürge, Panoussis, & Weber, 1997; Goo & Sassenrath, 1980; Line, Morgan, Roberts, & Markowitz, 1990; Reinhardt, Reinhardt, & Houser, 1986; Rolland, 1991; Schapiro & Bushong, 1994).

The frequent occurrence of self-biting in individually caged macaques is an alarming sign that the housing conditions are not appropriate. To prevent the development and reduce or eliminate the occurrence of self-biting in caged macaques, the animals’ inherent social needs must be addressed with much greater consistency. No exemptions should be granted—except for veterinary health care reasons—to the rearing and housing of primates in species-appropriate, compatible social settings. In the interests of both animal-based science as well as animal welfare, serious efforts must be made to remove the avoidable pain and distress resulting from pathological self-biting.

REFERENCES


