

## Reproductive Behavior of the Stallion

**Sue McDonnell, Ph.D.\***

The article begins with a brief description of the reproductive behavior of semi-wild and feral horses, which is intended to provide a background on the reproductive patterns and the specific behavioral elements comprising courtship and mating in the horse. The remainder of the article focuses on the domestic stallion. Various breeding conditions are described, including normal breeding performance. Finally, considerable attention is devoted to sexual behavior problems.

### SEMI-WILD AND FERAL ENVIRONMENT

Considerable observational information has amassed concerning the behavior of semi-wild and feral horses throughout the world. The following summary of reproductive behavior is based on descriptions of behavior of free-running horses in the Western United States and Canada, in the New Forest of Southern England, in Poland, and on islands off the coast of North America.<sup>1, 5, 8, 10, 13, 21, 24, 25, 29, 30</sup> Each of these populations, although free-running for most or all of the year, is subject to breeding or population management.

#### Reproductive Patterns

Free-running horses are polygynous, seasonal breeders with some overlap of the late spring to midsummer foaling and mating seasons. Breeding occurs within a harem group that generally consists of one stallion and several mares with their foals and yearling offspring. The harem group is a relatively stable social unit year-round. Most of the matings observed among the Pryor Mountain, Western Canadian, Polish, and New Forest populations are between April and July. Although most harem mares will be bred by the harem stallion, younger mares may be bred by 2-year-old colts that are occasionally tolerated as group members by a harem stallion. Harem offspring generally leave the family group to join another band before breeding age.

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\* Section of Reproductive Studies, New Bolton Center, University of Pennsylvania School of Veterinary Medicine, Kennett Square, Pennsylvania

Reproductive behavior of the stallion principally includes (1) harem formation and maintenance, and (2) courtship and mating. Each of these activities includes a number of distinct behavioral responses and sequences.

### **Harem Formation and Maintenance**

The harem stallion displays several responses that seem aimed at keeping the group together and directing its movement away from mares or stallions from other harems. The harem stallion tends to move around the periphery of the mares when they are grazing or resting or runs behind the group when it is on the move. A set of behaviors, referred to as "herding" or "driving," is depicted in Figure 1. The peculiar behavioral sequence known as snaking occurs within this context, especially if another stallion is nearby. While driving a mare or the group, the head and neck are lowered and the ears are laid back tightly in a threat position (Fig. 1B). The head may sway from side to side, as well as rotate about the rostral-caudal axis. These herding responses are also seen in the courtship sequences, seemingly aimed at separating the mare from the group. The stallion may grasp along the mane while driving a mare (Fig. 1D).

The harem stallion exhibits a relatively keen attentiveness to potential threat or intrusion. The stallion is usually the first to approach a non-harem member entering the area. An intruding stallion is usually met at the edge of the group with ritualistic posturing, which may lead to fighting. This posture includes arched neck, raised tail, prancing gait, and stomping. Stallion fighting is characterized by striking with the forelegs, often while rearing on the hindlegs.

**Elimination and Marking.** Stallions exhibit a characteristic set of responses to urine and feces that seems to be related to formation and maintenance of the harem. These often ritualistic responses include approaching, investigating, and covering of voided urine and feces of harem mares (Fig. 2). Investigation includes pawing and sniffing, typically followed by performance of the flehmen response. Flehmen, also known as "lip curl" or "horse laugh," is a response common to male ungulates. It is believed to facilitate movement of fluids to the vomeronasal organ, an accessory olfactory organ along the nasal septum. In the horse, flehmen consists of curling the upper lip upward, drawing air and fluid slowly through the teeth and flared nostrils, and extending the head and neck upwards (Fig. 2B). The lower jaw may be rhythmically lowered and raised, and the teeth may be parted slightly while the tongue is arched against the rostral palate.<sup>14</sup> The lower lip may droop and quiver. The eyes roll downward and the head may be rotated slowly from side to side. During and following the flehmen response, clear fluid usually drips from the nostrils. Flehmen response in the horse is a markedly sexually dimorphic response, occurring with much greater frequency in the adult male than in mares or foals.<sup>4</sup> Covering behavior includes deposition of feces or small amounts of urine on top of the stimulus material. These investigative and covering responses typically occur in rapid succession, so that the

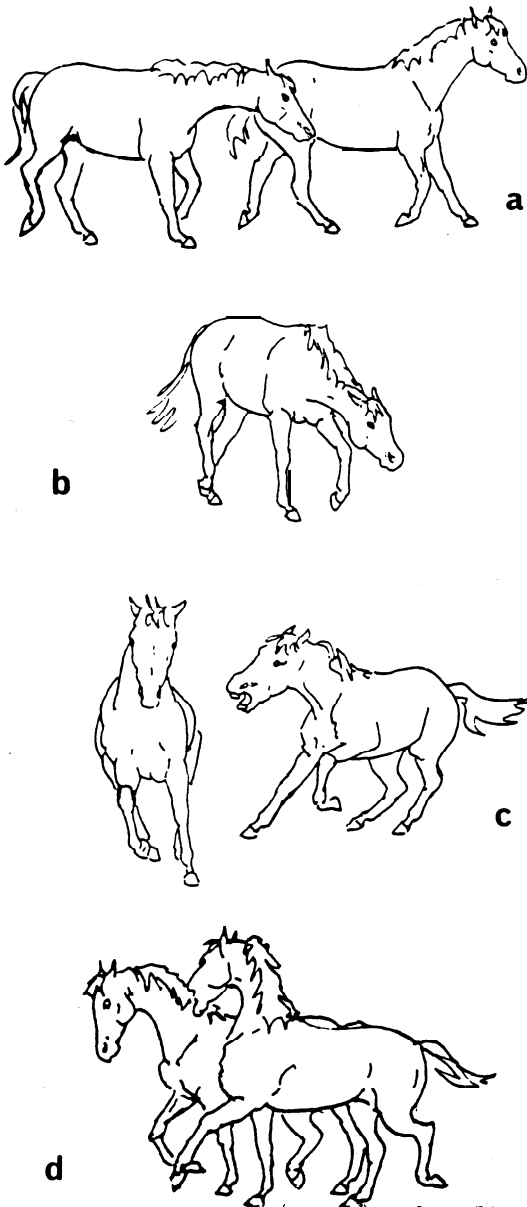


Figure 1. Herding and driving. Herding (*a* and *d*); snaking (*b*); and chasing (*c*).

stallion may approach the fecal pile or urine puddle, paw, sniff, perform flehmen while stepping forward, urinate on top, turn and sniff, perform flehmen, step forward, defecate on top, then turn and sniff again. Urination by a group member typically elicits approach, investigation, and covering with urine by the harem stallion. When a

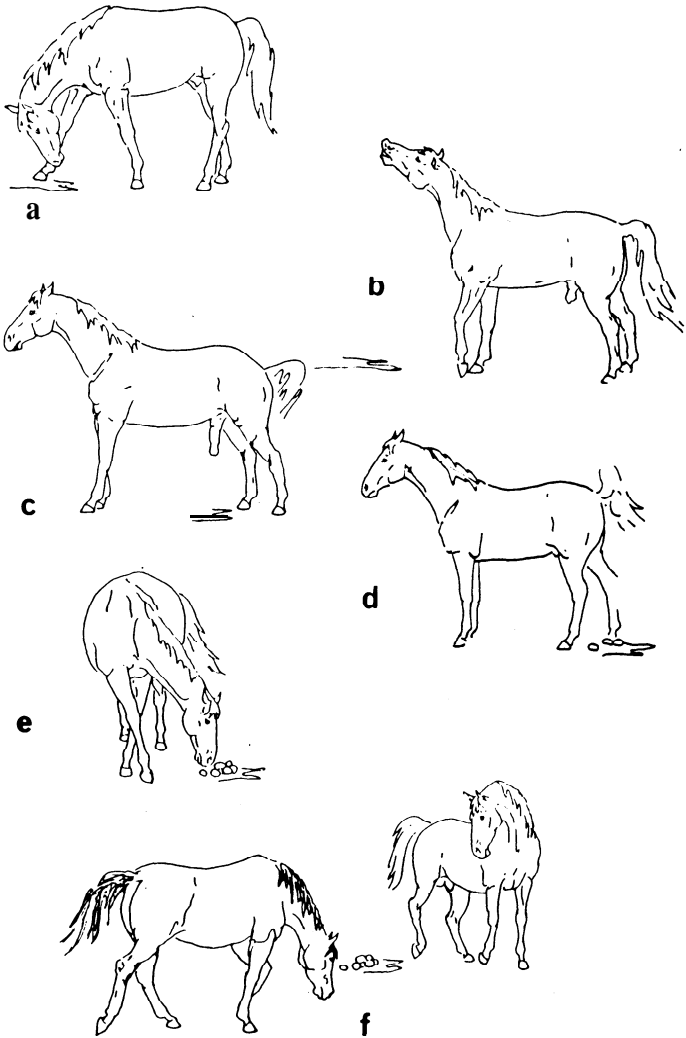


Figure 2. Elimination/marking.

stallion enters a new area, he may prance from one fecal pile to another, performing this ritual sequence at each. **Repeated defecation in a particular area results in accumulation of fecal matter into large mounds, which are known as "stud piles."** Figure 3 depicts small stud piles, which often accumulate along fence lines of pastured horses. Stud piles may be used by several stallions, resulting in large stud piles along common paths. The piles are often the site of posturing and fighting among stallions.

### Courtship and Mating

The stallion typically approaches a mare in a prancing gait with arched neck and raised tail (Fig. 4); it is often a sudden transition from

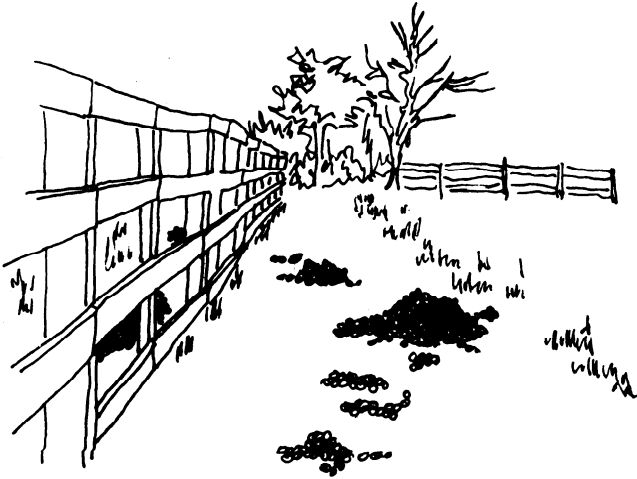


Figure 3. Stud piles along fenceline.

quiet grazing or resting to excited interest in the mare. The stallion may paw or stomp and usually nickers or whinnies as he approaches the mare. In the days preceding estrus, the stallion may repeatedly show interest in the mare. Typically, these early courtship interactions are aggressive in nature. The mare may display a combination of kicking, threat posturing, nipping or biting, and squealing, with tail held firmly down against the perineum. The stallion nips at the mane, shoulder, or flank and may kick or strike. If the mare's nonreceptive, aggressive behavior continues, the stallion usually moves away. Even when a mare is in full estrus, the interaction preceding copulation

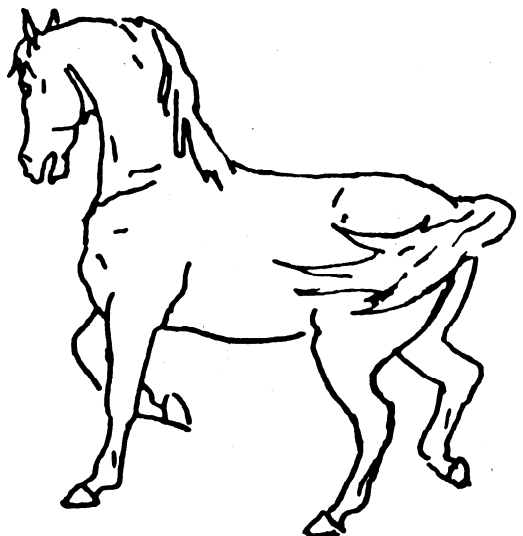


Figure 4. Stallion-typical approach posture and gait.

may begin with a mild aggressive sequence that gradually subsides to quiet precopulatory interaction. Responses of the mare in full estrus include lifting the tail, rhythmic eversion of the vulva exposing the clitoris and expelling urine or possibly vaginal fluids, frequent urination, squatting, following, and presentation by backing toward the head and shoulder of the stallion. Mares in full estrus typically maintain proximity to the stallion, frequently "presenting" as he grazes. Precopulatory behavior of the stallion includes sniffing, nuzzling, licking, and nibbling or nipping of the head, shoulder, axillary regions, belly, flank, inguinal, and perineal areas of the mare, typically in that order. Oronasal contact with urine, feces, or vaginal fluids is often followed by a flehmen response. During the olfactory investigation phase of precopulatory interaction, erection proceeds gradually. The penis drops from the prepuce and gradually becomes firm. Erection is usually complete before mounting.

Mounting is typically achieved by a rear approach but may be accomplished by a lateral mount with subsequent adjustment to the rear position. The latter approach has been observed more commonly among young stallions. Upon mounting, the stallion clasps his forelegs around the iliac crests of the mare with his head held tightly against the mane. Sometimes stallions will nip or grasp the mane with the teeth. Intromission normally occurs after one or more "seeking" thrusts. Once intromission occurs, the stallion usually plants his hind feet on firm footing and "couples up" closely to the mare. Ejaculation occurs after several deeper intravaginal thrusts. Indications of ejaculation include rhythmic contraction of the muscles in the rear legs, increased respiratory rate, drooping of the head against the mane of the mare, and a characteristic up and down jerky swish of the tail, commonly known as flagging or tail flips. As ejaculation commences, the stallion shows a characteristic relaxation of the facial muscles and a drooping of the ears similar to the mating facial expression of the mare (shown in a domestic stallion in Fig. 5). The stallion dismounts within 15 seconds after ejaculation. Postcopulatory responses include sniffing and flehmen response to spilled ejaculate or urovaginal secretions of the mare. The stallion may urinate or defecate over these, as described above.

Characteristic vocalizations throughout courtship and mating include loud, long whinnies and loud nickers by the stallion when approaching the mare; sharp squeals, roars, and grunts from both the stallion and mare during aggressive interactions; soft nickers from the stallion when approaching a mare in the posture of full estrus and just before mounting; and a short, soft squeal from the stallion during dismount.

A mare and a stallion may separate from the harem group during courtship and mating but often the harem mares and their young are nearby. The mare's own foal or yearling and other harem mares have been observed interfering with copulation by biting at the mare or threat posturing.<sup>30</sup>

Although there is usually considerable precopulatory interaction

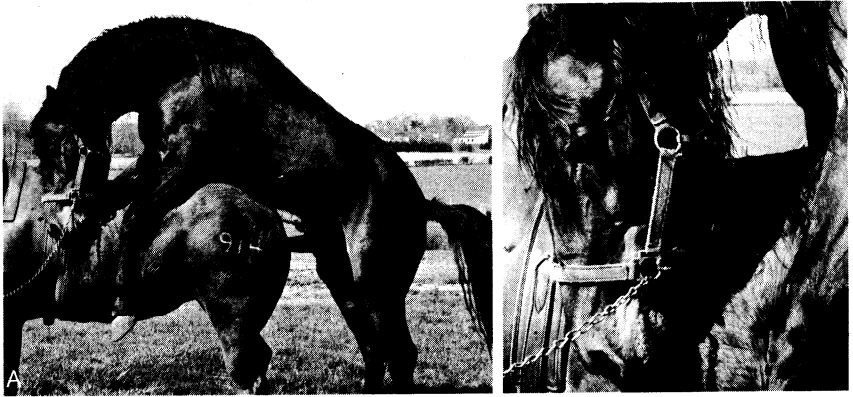


Figure 5. Ejaculation. (a) Tail "flip" or "flag" during ejaculation. (b) Post-ejaculatory relaxation.

with a mare over a period of hours or days before copulation, a copulatory interaction, from approach to ejaculation, often occurs in a period of less than 1 minute. The refractory period following ejaculation, during which the stallion shows no interest in breeding, appears to be short in free-running stallions. Feist observed a stallion copulate twice with the same mare within 7 minutes.<sup>5</sup> Tyler observed a New Forest stallion copulate with two mares, three times each, in a 2-hour period.<sup>30</sup> Kownacki and coworkers observed a stallion copulate three times with the same mare within 1 hour, with ejaculation apparent for two of the three copulations.<sup>13</sup>

Among free-running horses, there seems to be considerable variation in sexual behavior of individual stallions. A striking feature of equid behavior is that some stallions gain access to mares by associating with harems while others exist in groups of males, known as bachelor groups, with little or no opportunity to copulate? This phenomenon appears to be a normal, highly organized social arrangement related to age and dominance. Among harem stallions, some variation in mating technique, endurance, and apparent efficiency has been noted, but specific sexual behavior abnormalities have not been described.

In summary, reproductive behavior of free-running stallions includes, in addition to courtship and mating, responses and sequences involved in establishing or joining and maintaining a stable harem in which to breed. The behavior suggests visual, olfactory, gustatory, auditory, and tactile sensory mediation supporting the interactive sequences. Further, the seasonal breeding and bachelor group phenomena suggest rather complex mechanisms controlling reproduction in the horse. Although the various mechanisms are not understood, recognition of these processes may be useful in understanding the behavior of the domestic stallion.

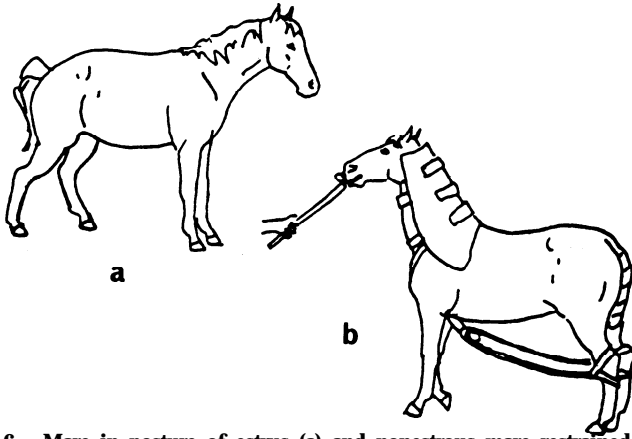
## DOMESTIC ENVIRONMENT

In the domestic environment, the sociosexual behavior of the horse is restricted. Interaction with conspecifics, social groupings throughout life, and reproduction are controlled to varying degrees. In reproduction, mate selection and precopulatory behavior are most affected. Domestic stallions are generally maintained in physical separation from other horses. On most farms, stallions are stabled or pastured near other stallions away from mares. Interaction with mares is almost always limited to controlled access to mares that are to be bred. The mares may be maintained on the same farm or may be brought to the stallion or farm only for the breeding service.

Copulation is permitted under one of three general breeding arrangements: (1) natural cover pasture breeding, in which the stallion and one or more mares are allowed to interact freely in an outdoor paddock; (2) natural cover in-hand, which involves presentation of the stallion under halter to the mare on one or more days when the mare shows behavioral estrus or when it has been determined by palpation of ovaries per rectum that ovulation is imminent; or (3) artificial insemination, which requires the collection of semen via artificial vagina or condom followed by intrauterine infusion of raw or extended semen to one or more mares. Natural cover in-hand and artificial collection of semen may be done in an indoor or outdoor breeding area that is used for all stallions on the farm. Domestic breeding procedures also include the use of dummy mount mares and nonestrous restrained mount mares. The stallion may be muzzled with a wire basket or plastic bucket over the nose and mouth to prevent injury to the mare or handler from biting. The mare's legs may be secured with breeding hobbles to inhibit kicking. The mare is commonly restrained by twitch to ensure that she will stand firmly for the stallion. A nonestrous mare restrained with breeding hobbles and twitch is shown in Figure 6. Also shown is a breeding cape used to protect the mare from injury when the stallion grasps the mane crest or neck with his teeth. For natural cover, a heavily padded bat, known as a breeding roll, may be placed between the mare and stallion to prevent internal injury to the mare from deep insertion of the penis. It is also common practice to wash the stallion's penis and the vulvar region of the mare before, and sometimes after, copulation.

A notable feature of domestic horse reproduction, particularly the Thoroughbred, Standardbred, Morgan, Saddlebred, Quarter Horse, Appaloosa, and Arabian registries, is that the majority of breeding is done in the late winter and early spring rather than during the natural breeding season (late spring and early summer). This is done so that foals are born as early in the year of their arbitrarily designated January 1st birth date as possible, making them more mature and presumably more competitive for aged show, race, or performance events. To facilitate this shift in breeding season, mares may be exposed to artificially long photoperiods (16 hours) beginning in November or De-





**Figure 6.** Mare in posture of estrus (a) and nonestrous mare restrained with twitch and hobbles, with breeding cape and tail wrap (b).

ember, which, in most mares, results in early emergence from winter anestrus.<sup>6</sup>

Breeding stallions are sometimes used as an aid in detecting estrus, especially on small farms that do not maintain a stallion specifically for this purpose. Estrus detection, commonly referred to as "teasing," involves daily or every-other-day exposure of the mares to the teaser stallion across a barrier that prevents copulation but allows visual and olfactory contact. Under such conditions, mares in estrus will usually display detectable proceptive and receptive behavior, whereas mares in diestrus exhibit typical nonreceptive and aggressive behavior. The stallion response, which usually varies with the reproductive state of the mare, also serves as an indication of whether or not the mare is in estrus.

### **Normal Response**

Generally, domestic stallions are cooperative and show adequate sexual arousal and response under intense breeding management. During teasing, they remain sexually responsive despite handling constraints. During breeding they quickly achieve and maintain erection, tolerate washing of the penis, mount a mare or dummy when signaled by the handler, and ejaculate into an artificial vagina or mare within one or two mounts. Individual stallions usually exhibit consistency in response over time. Among inexperienced stallions, arousal and response may be slower and less consistent for the first few breedings. The majority of domestic stallions will breed a receptive mare at any time of the year.

Ranges and means for each of several specific response endpoints for "normal" stallions are presented in Table 1. Precopulatory values are based on observations of 100 stallions, aged 3 to 18 years, representing 12 breeds, under comparable conditions at 3 different loca-

Table 1. *Sexual Response of Normal\* Stallions*

	RANGE	MEAN
<b>Precopulatory Endpoints (n = 100)</b>		
<b>Frequency of precopulatory responses</b>		
Before first mount:		
Sniff/nuzzle mare	<b>0-80</b>	<b>6</b>
Lick mare	<b>0-20</b>	1
Flehmen response	<b>0-10</b>	<b>2</b>
Nip/bite mare†	0-25	1
Kick/strike mare	<b>0-10</b>	<b>1</b>
Vocalize	0-35	3
Time to erection (sec):	0-500	67
Time to first mount with erection (sec):	<b>10-540</b>	<b>100</b>
<b>Copulatory Endpoints (n = 33)</b>		
Number of mounts to ejaculation	<b>1-3</b>	<b>1.4</b>
Mount time for ejaculatory mount (sec)	<b>17-45</b>	27
Number of thrusts on ejaculatory mounts	<b>2-12</b>	7
Total time in breeding area (sec)	30-240	150

\* Considered normal by owners and veterinarians.

† Nibble, nip, or bite without breaking skin.

tions.<sup>20</sup> Copulatory endpoints are based on response of 33 stallions during collection of semen with an artificial vagina under comparable conditions during breeding season months (March through September.) All stallions were considered by their owners and veterinary clinicians to have normal sexual behavior. Most of these stallions exhibited some precopulatory interaction, achieved a full erection within 1 minute, and mounted within 1 or 2 minutes after erection. Over 70 per cent achieved ejaculation with one mount, and over 90 per cent with one or two mounts. **Two** thirds of the stallions studied ejaculated after five to eight deep intravaginal thrusts. Of 75 stallions allowed to mount regardless of the stage of erection, 15 (20 per cent) mounted the mare without full erection.

## CONTROL OF REPRODUCTIVE BEHAVIOR

The mechanisms controlling reproductive behavior in the stallion are not clearly understood. However, there is some information concerning factors influencing stallion behavior.

### Endocrine Factors

Gonadal hormones play an important, although not well understood, role in stallion behavior. Androgens are generally necessary for normal development and expression of stallion-like behavior. Prepubertally castrated colts generally do not develop normal sexual be-

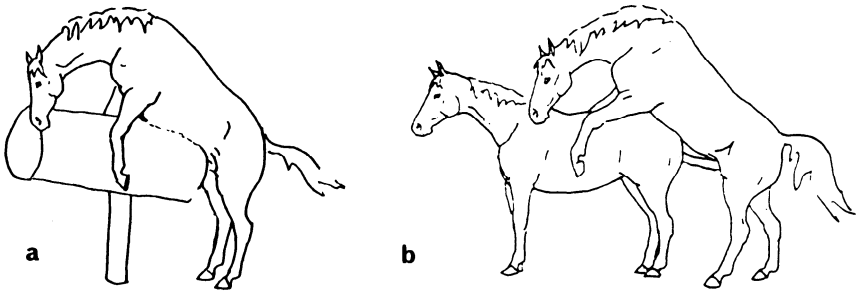
havior. Postpubertal reduction of androgens to very low levels, as in castration of the mature stallion, generally leads to a reduction in sexual response.<sup>15</sup> However, near normal sexual behavior may persist long after castration, especially in experienced breeding stallions. Within the normal range of values for intact stallions, there seems to be little correlation between level of androgen and level of sexual behavior.<sup>22</sup> Similarly, seasonal changes in hormone levels are not always accompanied by changes in sexual behavior. Administration of exogenous androgen to intact normal stallions does not increase sexual behavior.<sup>2, 16</sup> Moreover, it has been difficult to identify characteristic patterns or levels of steroids or gonadotrophins among slow or problem breeders.<sup>7, 31</sup>

### Experience

Sexual behavior of domestic stallions is clearly influenced by experience. The classic evidence for 'an important effect of experience is lingering sexual behavior of geldings. Equally strong evidence for the influence of experience, or learning, on sexual behavior can be found among intact stallions. Breeding stallions readily learn to respond sexually to nonsexual stimuli associated with breeding. For example, most experienced breeding stallions display erection before reaching the stimulus mare. Apparently, they recognize routines, equipment, or locations associated with breeding. Training for in-hand breeding is dependent on similar associative learning or conditioning. After repeated pairings of a dummy mare, a restrained non-estrous mare or an artificial vagina with sexual stimuli, the objects alone elicit sexual arousal and response. Training of breeding stallions also involves systematic application of reinforcement and punishment, known as operant conditioning or shaping, to gradually encourage stallions to tolerate the washing of the penis, to serve an artificial vagina, or to mount a dummy.

Similar conditioning forms the basis of training stallions to not exhibit sexual behavior when exposed to mares during racing, work, or performance. Interest in mares, erection, or even penis drop are systematically discouraged with verbal or physical reprimand. In animals that persist, a stallion ring is often used to inhibit erection. A stallion ring is a plastic or fabric band placed on the shaft of the penis. This device inhibits erection by physically restricting tumescence and apparently causing discomfort. The "brush," a stiff-bristled brush strapped to the belly, employs similar learning principles to discourage masturbation in stallions.

In recent experiments,<sup>18</sup> we subjected mature, sexually active pony stallions to an aversive conditioning with a paradigm analogous to the conditions used to discourage sexual behavior in stallions. The conditioning consisted of punishment of erection coupled with negative reinforcement of penis withdrawal. This procedure rapidly suppressed sexual arousal, and the resulting behavior resembled that of stallions with serious spontaneous sexual behavior dysfunction. By applying the aversive conditioning with only one of two stimulus



**Figure 7. Mounting positions. Stallion mounting dummy shown with good coupling (a). This is in contrast to stallion mounting mare shown with poor mounting position (b).**

mares, we have produced stallions with mare-specific sexual behavior dysfunction.

### **Stimulus Mare**

Most stallions will respond or can be trained to respond adequately to a suboptimal stimulus animal (as in Fig. 6B) or even a dummy mount mare (Fig. 7A). However, for most stallions, a mare in strong natural estrus (Fig. 6A) elicits a stronger sexual response than a dummy or an ovariectomized stimulus mare.

## **REPRODUCTIVE BEHAVIOR PROBLEMS**

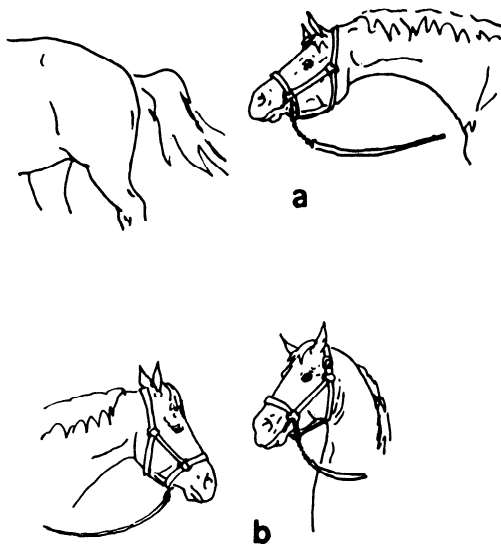
What constitutes problem behavior varies considerably, depending on managers' expectations for speed of copulation, endurance, and cooperation with various levels of human handling and artificial techniques. Each problem case has a unique set of behavioral and situational characteristics, making classification of sexual behavior problems difficult. The following are some common behavior problems that may occur alone or in combination with others.

### **Low Interest or Slow Arousal**

Sexual behavior problems and dysfunction in the horse have been referred to as libido problems. This term best fits one type of problem, the slow breeder. Such stallions may fail to show sexual interest in estrous mares. They may show some investigatory interest when encouraged but are easily distracted. Some may require more than an hour to achieve erection and mount. Some slow breeders show normal arousal and response if given long periods of sexual rest between breedings. Slow arousal and awkward approach occur frequently in young or novice breeding stallions. These animals, although interested, often appear confused and fearful when first presented to a mare

(Fig. 8). Although most stallions quickly gain confidence, especially following even one successful ejaculation, others may take weeks or months to achieve acceptable breeding performance.

A particularly curious syndrome of anomalous behaviors has been noted in several novice breeding stallions (McDonnell, Kenney, and Garcia, unpublished observations). In addition to the common problems of awkward approach, slow interest, and lack of confidence seen in many young or novice stallions, these animals showed marked disinterest in mares and unusual attachment to humans. Their owners and veterinarians remarked that they were "human bonded." In the presence of a mare, these animals were more attentive to the activity of the human handlers or observers than the mare. If encouraged or forced to approach a mare, these stallions seemed fearful, bored, confused, or resistant. In some instances, these stallions showed juvenile responses and a subordinate posture in response to mares. On several occasions, mares that had shown strong proceptive responses to other stallions on the same day responded to these stallions with aggressive or ambivalent behavior. These animals either failed to respond sexually to a mare while in the presence of a human or responded sexually only to humans. In two recent cases, erection would occur only if the stallion was allowed to lick the hand of a human handler for several minutes. In one of these cases, erection would occur only with one particular handler. In each case, the stallion was extraordinarily quiet and compliant with handling demands. It appeared that these animals had become conditioned to respond sexually to humans and were ambivalent or inhibited by other horses.



**Figure 8** Novice stallion showing tentative approach (a) and fear and lack of confidence (b) with estrous mare.

## **Ejaculatory Failure**

Some stallions show normal interest, arousal, and response but fail to ejaculate. In some cases, there may be problems with intromission, coupling, or thrusting (Fig. 7B), but even when all elements of the copulatory sequence seem normal, ejaculation may not occur. These stallions may mount 20 or 30 times before ejaculating or becoming too exhausted or frustrated to continue. A related problem often found in stallions with ejaculatory difficulty is dismount during or before ejaculation. Also a problem are stallions that fail to emit semen, with no detectable difference in behavioral signs of ejaculation. Some stallions occasionally or consistently emit accessory gland fluids void of spermatozoa. Such unsigned intermittent ejaculatory failure is particularly frustrating to manage and can be devastating to a natural-service breeding program.

## **Inconsistent Performance**

Perhaps the most frustrating sexual behavior problem in the stallion is inconsistency in performance. The extreme case is the stallion that breeds with gusto one day and fails to show interest the next. Occasionally, stallions appear to prefer or have an aversion for certain mares, handlers, or locations. Many stallion managers are able to facilitate breeding success of such stallions by accommodating preferences or aversions.

## **Excessive Aggression**

Some breeding stallions are uncontrollably aggressive toward mares or handlers. Although biting, striking, and kicking are normal elements of the precopulatory sequence, "savage" aggressiveness is one of the most serious behavior problems. Many stallions are consistently aggressive, but more difficult to manage are those that are unpredictably aggressive.

## **"Stale" or "Sour" Attitude**

After long periods of normal, consistent sexual performance, some stallions rather abruptly develop aberrant behavior, including slow breeding and/or ejaculatory failure. It is not uncommon for these stallions to become abnormally aggressive toward mares or handlers. This problem is believed to be related to overuse.

## **Masturbation**

Most stallions extend the penis and exhibit erection periodically when resting in their stall. Some appear to masturbate by rhythmically bouncing the penis against the belly, sometimes with pelvic thrusts. Ejaculation is not frequently observed, but it has been confirmed. Recent experimental work suggests that ejaculation during masturbation may be a rather rare event.<sup>28</sup> Masturbation occurs even in normal breeding stallions. It is not clear whether masturbation affects sexual behavior or fertility. However, managers find it particularly

frustrating to work with stallions that fail to respond under normal breeding conditions, yet achieve erection and masturbate when returned to the stall.

### **Other Vices**

In addition to specific sexual behavior problems, breeding stallions may exhibit an array of stable vices, which although not unique to stallions, appear to be more common in stallions than in geldings or mares. Common problem activities include wall-kicking, wall-climbing, stomping, door-kicking, and self-mutilation. The nature of these activities may range from what seems to be playful or attention-getting hyperactivity to frank goal-directed destructiveness. Such vices may occur alone, but more commonly in combination with others. A number of activities may be performed in a ritualistic sequence. A common feature of stallion vices is that the activity produces noise that is often rhythmic. The animal may also scream or roar in association with the activity. As with stable vices in general, stallion stable vices seem to be associated with confinement and inactivity. The problems sometimes worsen as exercise decreases and may resolve if toys or stallmates, such as goats or rabbits, are provided.

These activities are not specifically a reproductive behavior problem, except in the often life-threatening or fertility-limiting syndrome of self-mutilation. The animal may compulsively nip, bite, or tear at the flank, stifle, or chest, with resulting skin irritation, excoriations, and tissue avulsion. Repeated wall-kicking or floor-stomping may result in injury to hocks or feet. Some animals lunge into the wall, bruising the shoulder. A recent survey of breeding farm managers (Kenney, personal communication, 1986) revealed a few notorious self-mutilating stallions that have been closely related, suggesting an inherited tendency to develop such behavior. In some stallions, self-mutilation seems seasonal, either worsening or improving during the breeding season. In others, no seasonal variation was observed. An interesting finding was that self-mutilation is not limited to confined animals. It has been noted in animals in training and performance. Two cases were noted in which the behavior occurs only when the stallions are on pasture and not in the stall. In the cases surveyed, emergence of self-mutilation was postpubertal. Techniques employed with varying success include paddock toys; companion goats or rabbits; physical restraint, including head cradles and side poles; turn-out housing arrangements; and exercise regimens. In many cases, physical restraint fails, as the animal compulsively struggles to perform the activity or initiates an alternate technique of self-destruction. In one case surveyed, a desperate attempt to resolve a life-threatening self-mutilation problem by castrating the stallion was successful.

### **Stallion Behavior in Geldings, Foals, and Mares**

**Geldings.** A common sexual behavior problem is the gelding that continues to show normal sexual behavior toward mares. Stallion behavior is often assumed to be more common among geldings with

considerable breeding experience before castration. Line and colleagues found no difference in the percentages of pre- and postpubertally castrated geldings that exhibited stallion-like sexual and aggressive behavior? Occasionally, animals assumed to be geldings are found to have a retained testicle producing androgen (Kenney and Garcia, personal communication).

**Foals.** It is common for foals, even in the first few days of life, to mount their dam. Mounting is less commonly seen in fillies, but it does occur, especially during the first few weeks. Prepubertal colts may exhibit erection and other elements of the male-type sexual behavior, usually not linked in complete sequences. However, colts, as early as their dam's foal heat, may exhibit approach, olfactory investigation, flehmen, elimination/markings, erection, and mounting responses, appropriately sequenced and oriented. Although not well studied, this early sexual behavior should be considered as normal developmental behavior.

**Mares.** Unlike in the cow, male-type sexual behavior is not normal in the mare. Stallion-like sexual and aggressive behavior has been seen in mares under a variety of abnormal hormonal conditions. Mares with steroid-producing ovarian tumors or mares given androgenic anabolic steroid preparations may show near-complete, stallion-type behavior, including teasing, herding, flehmen, vocalizations, elimination/markings, mounting, and thrusting.<sup>19, 27</sup> The male-type behavior may persist long after treatment has stopped and circulating androgen levels have returned to normal. Occasionally, mares develop stallion-like behavior during pregnancy. Elevated steroid levels, including androgenic steroids, are a normal feature of pregnancy in the mare. Although stallion-like behavior occurs in only a small percentage of pregnant mares, it may be related to increased steroid levels.

### **Incidence and Etiology of Behavior Problems**

Incidence of fertility-limiting behavior problems in stallions in general remains difficult to estimate. A survey of 80 stallions presented to the Hofmann Center Equine Fertility Clinic for breeding soundness evaluation during a 12-month period (July 1984 to June 1985) revealed that of 47 stallions presented for the first time with no known or suspected fertility problem, 8 were found to have inadequate sexual behavior. In addition, four new case stallions were presented principally for a known or suspected behavioral component of infertility. Therefore, nearly 25 per cent of the new cases at this clinic involved fertility-limiting sexual behavior. Numerous others were reported by telephone or evaluated on farms. The clinical population of the Hofmann Center principally comprises highly valuable Thoroughbred, Standardbred, Arabian, Morgan, and warm-blooded performance stallions from the Middle Atlantic and New England states.

Sexual behavior problems occur in horses of all breeds, ages, and principal work types (sport, race, draught). Based on the types of cases referred to our equine fertility clinic, it would appear that problems



may occur more frequently among certain classes of stallions: (1) stallions in transition from a race or performance career to breeding, (2) young stallions, (3) novice breeders, (4) stallions with an intense breeding schedule, and (5) stallions in a new environment. In addition, the problems are often more likely to occur during the early or late months of the breeding season.

Sexual behavior problems in stallions sometimes appear to develop secondary to pain or injury. Painful back, leg, or genital injuries may result in failure to mount, couple up, or thrust adequately. The behavior problems often persist after the injury has healed.

Owners sometimes relate the problem to a particular experience. Occasionally, horses that have bred normally for years develop problems coincident with a traumatic breeding experience, such as a kick from the mare, a beating by the handler, or an accident in the breeding shed.

Over the years, there has been considerable concern about whether there might be a genetic component to sexual behavior or dysfunction. It is tempting to imagine a "psychosexual" constitution that may, like general temperament, be inherited. Sexual behavior does vary with breed, especially from light to heavy breeds, and from small ponies to horses. But there is little valid evidence to either support or refute the hypothesis that certain individuals carry a genetic predisposition to sexual behavior dysfunction.

### **Evaluation and Therapy**

The general objectives of evaluation should be to (1) define the specific problem and its history, identifying any missing elements, anomalous responses, or temporal peculiarities; (2) evaluate endocrine status by examining the stallion for normal secondary sexual characteristics of stallion conformation, posture, and attitude, as well as the presence of testes of normal size and consistency, and by measuring circulating androgens; (3) identify any limb, back, or genital injury or lingering pain (including the presence of a stallion ring) that might account for problem behavior; and (4) determine whether the problem is specific to a certain handler, location, type of artificial vagina, or other aspects of the breeding situation.

Typically, the managers of the stallion have already tried a number of changes in the breeding regimen, and such information is of value in defining the problem. It is often essential to observe the stallion in his home breeding environment.

A checklist of responses should include the precopulatory and copulatory responses listed in Table 1 (section on normal response). Any additional responses should be noted. For example, it is not usual behavior for a stallion to eat grass or gaze off into the distance when presented to an estrous mare. Some stallions show each of the normal responses but seem to become fixated on a particular response. For example, some stallions show excessive licking of the mare and fail to complete the normal sequence in a timely fashion ("hock lickers").

When these stallions fail to sniff or perform flehmen, anosmia should be suspected and evaluated. Head-shaking, pawing, kicking, severe biting, and other signs of frustration should be noted.

**Behavior Modification.** Some problems resolve with simple changes tried during the evaluation. However, many stallions require systematic behavior modification, or "retraining." The project of retraining a stallion is a special challenge requiring a well-coordinated team of patient, able people. Greater success can be expected if this retraining is done during a time period set aside specifically for this work, when distractions and time pressures will be minimal. Although the specific procedures vary, there are some general principles to consider when retraining a stallion.

Occasionally, simply preventing an unwanted or distracting response will solve the problem. A muzzle to prevent excessive licking or biting may be all that is necessary to facilitate breeding.

One of the early goals of retraining, especially for stallions that have never achieved ejaculation, is to make as much day-by-day progress toward ejaculation as possible. Many of these stallions show marked improvement once they have achieved an ejaculation. Therefore, it may be worth going to great lengths to achieve this goal.

When retraining a stallion, the positive features of the breeding situation should be maximized. A quiet mare showing strong natural estrus is probably the best choice of stimulus mare. If the stallion shows little interest in the standard stimulus mare, others should be presented. Occasionally, stallions do better if allowed to "choose" a mare from a group if more than one stimulus mare is available in the breeding area. The mount mare should be of an appropriate size for the stallion. A dummy mount may be useful for the stallion that seems afraid of mares. The footing should be solid and should not allow slipping. If indoors, the area should be large enough and the ceiling high enough so as not to inhibit the stallion. Some stallions seem to require more space than others. The tension and potential distractions in the breeding situation should be minimized. A confident, patient, and relaxed stallion handler is essential for retraining. Whenever possible, positive reinforcement should be used instead of punishment.

One of the simplest ways to approach retraining is to provide the stallion with more natural breeding conditions. Exposure to an estrous mare, such as in the adjacent stall, will sometimes facilitate sexual arousal and response. Pasture exposure to an older, quiet, solicitous mare often facilitates rapid improvement in the slow novice stallion. An outdoor breeding area may be better than a breeding shed. Less breeding equipment and fewer artificial procedures may be better for some stallions at first.

**Novelty Effect.** Changes in behavior, both positive and negative, may accompany a change in environment. For the stale horse or one that appears fearful of the breeding environment, a change in scenery occasionally leads to improvement in sexual attitude and response. Any break from routine, such as a new breeding area or stim-

ulus mare, a different exercise routine or paddock, or a different breeding schedule, may be effective.

**“Voyeur” Effect.** For reasons not well understood, slow breeders seem to benefit from exposure to breeding activity of other horses. A slow novice stallion placed in a stall within sight of the breeding area may show immediate marked improvement (Kenney, personal communication). Similarly, bringing another stallion to the breeding area may lead to almost reflexively spontaneous sexual arousal and response in a previously disinterested stallion.

**Androgen Therapy.** The deleterious effects of exogenous androgens should be considered before recommending such treatment for improving libido in breeding stallions. Numerous studies have shown that androgens will have adverse effects on spermatogenesis<sup>2, 3, 26</sup> and exogenous androgen may increase aggression without improving sexual behavior (McDonnell, unpublished observations). Presently, androgen therapy is recommended as a last resort only in stallions with low endogenous androgens whose behavior is so poor that ejaculation is unlikely without treatment. (Garcia, personal communication, 1985).<sup>9</sup> Before initiating androgen treatment, low endogenous levels should be confirmed in 2 or 3 samples taken over a 1- or 2-week period. Also, a gonadotrophin stimulation test can be used to evaluate the integrity of the pituitary gonadal axis and the ability of the interstitial cells to respond (Garcia, personal communication, 1985).

**Analgesics.** Nonsteroidal anti-inflammatory agents such as phenylbutazone and flunixin meglumine have been used to improve sexual behavior of stallions whose problems appear to be secondary to pain. This approach has been particularly useful in stallions with spinal or rear leg injuries, which are common among retired racing and performance stallions (Kenney and Garcia, personal communication, 1985).

**Other Drugs.** A number of neuromyotrophic drugs have been used in attempts to facilitate ejaculation in stallions that fail to ejaculate despite otherwise normal behavior, and in stallions that, in association with inability to ejaculate, exhibit frustration and overly aggressive behavior. Rasbech reported trying ephedrine, amphetamines, pilocarpine, and atropine as sympathomimetic promoters of accessory gland smooth muscle activity in six stallions with ejaculatory dysfunction.<sup>23</sup> Generally, results were negative or inconclusive. Nor-epinephrine and the beta-adrenergic receptor blockers have been used with some success to stimulate ejaculation.<sup>12</sup> Prostaglandin F<sub>2</sub> alpha and oxytocin have been used in an attempt to induce smooth muscle activity in accessory glands or facilitate emptying of sperm from the genital tract. In a preliminary study, prostaglandin F<sub>2</sub> alpha had no effect on semen volume, concentration, or total sperm numbers of three stallions (Sertich and Garcia, unpublished). The prostaglandin induced negative side effects, including profuse sweating, muscle cramping, and posterior weakness. Recent work suggests that psy-

**chotropic drugs may be a useful aid in retraining sexually inhibited stallions. The anti-anxiety drug diazepam reversed aversively conditioned suppression of sexual arousal and blocked the inhibitory effects of novel environment on sexual behavior in pony stallions? <sup>19</sup> However, none of these drugs should be recommended without further study.**

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Section of Reproductive Studies  
New Bolton Center  
School of Veterinary Medicine  
University of Pennsylvania  
382 West Street Road  
Kennett Square, Pennsylvania 19348