

NORMAL AND ABNORMAL SEXUAL BEHAVIOR

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FREE-RUNNING EQUIDS

Reproductive behavior has been studied in several free-running and semi-wild populations of feral domestic horse,^{2, 9, 14, 15, 18, 21, 27, 30-32, 37} Przewalski horse,^{8, 35} zebra,^{17, 28, 33} donkey,¹⁷ and wild ass.¹⁷ All equids are polygynous, seasonal long-day breeders. Two distinct breeding systems are represented among the equid species. The Grevy's zebra, wild ass, and donkey are territorial breeders, whereas the Plains zebra, Mountain zebra, Przewalski horse, and domestic horse are harem breeders. Territorial breeders establish and guard a territory, presumably one with good grazing, water, and shelter to attract and maintain females. Females that pass through or stay in a territory remain dispersed rather than clustered together, as in a harem group. Except for copulation, the territorial male shows little contact with the females. Females in or near estrus form a sexually active group that maintains proximity to the male. The male vocalizes periodically, which appears to draw the sexually active group closer to him.

In contrast, among harem breeding equids, the male establishes and maintains a particular group of females with their young. The group is a relatively stable social unit throughout the year, but the mares are more closely tended by the stallion during the breeding season than during the nonbreeding season. The area and resources used by a harem group typically overlap with those used by other groups. The harem stallion tends to move around the periphery of the mares, herding them together when they are grazing or resting. The

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VETERINARY CLINICS OF NORTH AMERICA: EQUINE PRACTICE

stallion usually is the first to approach and fend off a **nonharem** member in the vicinity. The stallion also stays behind and drives the group when it is on the move. 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 stallion's head and neck are lowered and the ears are laid back tightly in a threat position. The head may sway from side to side as well as rotate about the **rostral-caudal** axis. These herding responses also are seen in the courtship sequences, seemingly aimed at separating the mare from the group. The harem stallion exhibits a relatively keen attentiveness to potential threat or intrusion. 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. Young stallions that have left their natal harem band and mature stallions that are without a harem group travel together as a bachelor band.

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. Investigation includes pawing and sniffing, which typically is 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. The lower jaw may be rhythmically lowered and raised, the teeth may be parted slightly, and the tongue is arched against the rostral **palate**.¹⁹ 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 stallion than in mares or **foals**.⁷ 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 stallion may approach the fecal pile or urine puddle, paw, sniff, perform flehmen while stepping forward, urinate on **top**,³⁶ 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 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." These fecal piles may be used by several stallions, either sequentially or simultaneously. Posturing and fighting among stallions near stud piles are known as *fecal pile displays*.

The significance of the behavioral displays and the possible messages communicated through urine and feces remain speculative in equids, as it does in most mammals. Both in pastured harem groups and pastured bachelor bands, fecal piles accumulate near limited resources (e.g., a water site, fence line near mares, or shelter).

Courtship and Mating

Free-running horses engage in prolonged pre-mating interactions. Both mares and stallions appear to play an active role in mate location and precopulatory behavior. For days before copulation, mares linger near or follow the stallion, either alone or with other mares in estrus. These mares urinate, lift their tail, and present the hindquarters to the stallion as he grazes nearby, sometimes hundreds of times per hour (McDonnell SM, Bristol F, unpublished data, 1988). The stallion typically interacts with a sexually active mare or her excrement almost continuously for days preceding actual copulation. The stallion's approach to a mare may be either a gradual or a sudden transition from quiet grazing or resting. The sudden approaches are characterized by a prancing gait with arched neck and raised tail. The stallion may paw or stomp and usually whinnies from a distance and then nickers as he nears the mare. In early estrus, mares appear ambivalent in that they initially elicit the interest of the stallion from a distance but are aggressive or nonreceptive when approached by the stallion. As mares get **closer** to ovulation, they typically appear gradually more receptive to close interaction with the stallion. Even when a mare is in full estrus and normal copulation occurs, the interaction may commence with a mild aggressive sequence that subsides to quiet precopulatory interaction. 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 mare's mane, shoulder, or flank and may kick or strike. 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. Precopulatory behaviors of the stallion include 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. Contact with urine, feces, or vaginal fluids usually is followed by a flehmen response. Mounts without erection, interpreted as "testing" mounts, appear to be a normal element of the equid precopulatory sequence. Most free-running or pasture-breeding equids studied exhibit a high frequency of mount without an erection. In fact, among highly fertile pasture-breeding horses and donkeys, the number of mounts without erection is typically 1.5 to 2 times the number of mounts with erection (McDonnell SM, Bristol F, unpublished data, 1988).¹¹

Mounting typically is achieved by a rear approach but may be accomplished by a lateral mount with subsequent adjustment to the rear position. The latter approach appears to occur quite commonly among young or inexperienced stallions. Upon mounting, the stallion clasps his forelegs around the iliac crests of the mare with his head held tightly against the mare's mane. Sometimes stallions nip or grasp the mane with the teeth. For mounts with erection, the penis drops from the prepuce and gradually becomes rigid before mounting occurs. Among free-running equids, mounts with erection almost always lead to insertion and ejaculation. 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 hind legs, increased respiratory rate, drooping of the head against the mane of the mare, and a characteristic up and down rhythmic swish of the tail, commonly referred to as "flagging" or "tail flips." As ejaculation commences, the stallion shows a characteristic relaxation of the facial muscles and a dropping of the ears, similar to the mating facial expression of the mare. Dismount occurs within 3 to 15 seconds after ejaculation. Often the mare steps forward, facilitating dismount. 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 previously described.

Characteristic vocalizations throughout courtship and mating include (1) loud, long whinnies and loud nickers by the stallion when approaching the mare, (2) sharp squeals, roars, and grunts from both the stallion and mare during aggressive interactions, (3) soft nickers from the stallion when approaching a mare in the posture of full estrus and just before mounting, and (4) a short, soft squeal from the stallion during dismount.

A mare and a stallion may either separate from the harem group during courtship and mating or remain among the harem mares and their young. The mare's own foal or yearling and other harem mares have been observed to interfere with copulation by biting at the mare or threat **posturing**.³⁷

Although precopulatory interaction with a mare usually extends over a period of hours or days before copulation, the actual copulatory interaction, from approach to ejaculation, frequently is 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**.⁹ Tyler **observed a** New Forest stallion **copulate with two mares, three times each, in a 2-hour period**.³⁷ Kownacki and co-workers observed a stallion copulate three times with the same mare within 1 hour, with ejaculation apparent for two of the three **copulations**.¹⁸ It is important to note that all available data indicate that **among stallions breeding at liberty, whether semi-wild, feral, or pastured domestic stallions, the breeding frequency can be very high compared**

to what is seen under in-hand breeding. Breeding rates as high as 18 per day have been recorded in several different studies. Reported **first-cycle** pregnancy rates of free-running or pastured populations typically are well above the 75% level considered to be excellent for in-hand domestic breeding **systems**.^{2, 5, 6, 11, 12, 15}

A striking feature of equid behavior is that some stallions gain access to mares by associating with harems, whereas others exist in bachelor groups with little or no opportunity to **copulate**.¹⁷ This phenomenon appears to be a normal, highly organized social arrangement related to age and dominance. When a harem becomes available, one of the bachelor band stallions emerges to take the harem with little dispute from other bachelors, as though the order of access to a harem is an established aspect of the bachelor band. Among harem stallions, some variation in technique, endurance, and apparent efficiency of mating has been noted, but specific sexual behavior abnormalities have not been described.

In contrast to harem breeders, territorial breeders do not **continuously** interact with the females. For example, in donkeys the jennies form a very conspicuous sexually active group characterized by frequent female-female mounting. The jack periodically vocalizes from a distance. This appears to draw the sexually active group, which lingers a short distance from the jack. The jack appears aware of the sexually active group from his nearby rest area for many minutes before he abruptly approaches the group, usually mounting one or more jennies without erection, and then returning to his nearby rest area. Eventually, the jack achieves an erection at a distance from the group, while appearing uninterested. He then quickly approaches the group and copulates with a jenny. Jennies appear to have a longer, more obvious ambivalent phase of estrus than do horse mares. Jennies typically posture receptively toward the jack but then resist his mount by moving away or kicking. The copulatory sequence itself is remarkably similar among all equids, including total mount time (20 to 30 seconds), insertion time before ejaculation (**10 to 15** seconds), and number of thrusts (6 to 9).

Masturbation

All free-running equids normally display frequent erection and movements of the penis referred to as masturbation?²⁴ Masturbation was once believed to be related to confinement in domestic or zoo animals. However, it occurs with equal frequency in free-running and confined equids at the rate of once every 1 to 3 hours in undisturbed animals. Ejaculation is only rarely observed. Both field and laboratory observations indicate that level of spontaneous erection or masturbation is not associated with level of heterosexual response or fertility. Similarly, level of confinement or access to sexual behavior appears to have no effect on frequency or intensity of spontaneous erection and masturbation.

DOMESTIC ENVIRONMENT

In the domestic environment, the sociosexual behavior of the horse is restricted. Interaction with other horses, social groupings throughout life, and reproduction are controlled to varying degrees. In reproduction, mate selection and precopulatory behavior are most affected. Domestic stallions generally are maintained in physical separation from other horses. On most farms, stallions are kept in stalls or pastures alone or near other stallions. Interaction with mares typically is severely limited compared to that which would occur under free-running conditions.

Copulation is typically 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 examination 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 into 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 designated for use by all stallions on the farm. Domestic breeding procedures also include the use of a breeding dummy mare or an ovariectomized restrained "mount mare." The stallion may be muzzled to prevent biting of the mare or handler. Breeding hobbles may be fastened to the mare's legs to inhibit kicking. The mare commonly is restrained with a lip twitch to ensure that she will stand **firmly** for the stallion. 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 reproductive management of domestic horses, particularly the Thoroughbred, Standardbred, Morgan, Saddlebred, Quarter Horse, Appaloosa, and Arabian registries, is that most breeding is done during 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 as possible in the year of their arbitrarily designated January 1st birth date, making them more mature and presumably more competitive for age-dependent 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 December, which, in most mares, results in early emergence from winter anestrus.¹⁰ In such systems, stallions do much of their breeding outside the natural season. It has not been clearly established how important this is to stallion breeding behavior or whether subjecting stallions to similar lighting regimens can effect seasonal increases in stallion sexual behavior.

Breeding stallions sometimes are used as an aid in detecting estrus, especially on small farms that do not maintain a stallion specifically for this purpose. Estrus detection, referred to as "teasing," involves daily or every-other-day exposure of the mares to the teaser stallion in a manner that prevents copulation but allows visual and olfactory contact. Under such conditions, mares in estrus 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 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 breeding 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. Typically, an experienced stallion will breed a receptive mare at any time of the year, however, sexual response is generally slower during the nonbreeding season months.

Typical values for each of several specific response endpoints for "normal" stallions are presented in Table 1. These values are based on

Table 1. NORMAL PRECOPULATORY AND COPULATORY BEHAVIOR OF DOMESTIC HORSE STALLIONS

	Typical Value*	Range
Precopulatory response		
Sniff or nuzzle (frequency)	3	0-80
Lick (frequency)	0	0-20
Flehmen response (frequency)	2	0-10
Nip or bite (frequency)	0	0-25
Kick or strike (frequency)	0	0-10
Vocalization (frequency)	3	0-35
Time to erection (sec)	10	0-500
Time to first mount with erection (sec)	15	10-540
Copulatory response		
Number of mounts	1	1-3
Time from mount to insertion (sec)	2	1-5
Insertion time before ejaculation (sec)	15	8-20
Number of thrusts	7	2-12
Total mount time (sec)	20	15-45
Total time in breeding area (min)	2	0.5-10

*Based on statistical mode of sample including novice and experienced breeding stallions.

work with stallions of several breeds and ages in our laboratory and on breeding farms. Most stallions exhibit some precopulatory interaction, achieve erection within 1 to 2 minutes, and mount within 1 minute after erection. Over 70% achieve ejaculation within one mount, and over 90% within one or two mounts. Approximately two thirds of stallions ejaculate after five to eight deep intravaginal thrusts. Most stallions are remarkably consistent over time in their pattern of **preco**pulatory and copulatory behavior.

In contrast to domestic horse stallions, donkey jacks are typically slower to achieve erection and readiness to mount (several minutes to many hours), especially if teased within close proximity to the jenny. Jacks often respond more readily if allowed to tease at a distance from the jennies. Similarly, they tend to be shy breeders when bred in-hand (Henry M, personal communication; McDonnell SM, unpublished data, 1988).

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. **Gonadal** hormones play an important, though not well understood, role in stallion behavior. Androgens generally are necessary for normal development and expression of stallion-like behavior. Prepuberally castrated colts generally do not develop normal sexual behavior. Post-pubertal reduction of **andro**gens to very low levels, as in castration of the mature stallion, generally leads to a reduction in sexual response.²⁰ However, near-normal sexual behavior may persist long after castration. Within the typical range of values for intact stallions, there seems to be little correlation between level of androgen and level of sexual behavior. It has been well established that circulating androgen levels are highest during the breeding season.¹⁶ In domestic stallions, however, seasonal changes in androgen levels are not always accompanied by changes in sexual behavior. Administration of exogenous androgen to intact normal stallions does not increase sexual **behavior**.³ Moreover, it has been difficult to identify characteristic patterns or levels of steroids or **gona**-dotrophins among slow or problem **breeders**.¹³

Sexual behavior of domestic stallions is clearly influenced by experience or learning. 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. Stallions recognize routines, equipment, or occasions associated with breeding. Training for in-hand breeding is dependent on such associative learning or conditioning phenomena. After repeated pairings of a breeding dummy mare with a restrained estrous or nonestrous 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 breeding dummy mare.

Conditioning also forms the basis of training stallions not to exhibit sexual behavior when exposed to mares during racing, work, or performance. Interest in mares, spontaneous or sexual erection and masturbation, or even penis drop are systematically discouraged with verbal or physical reprimand. In animals that persist, a stallion ring is sometimes used to inhibit erection. A stallion ring is a metal, plastic, or fabric band placed on the shaft of the penis (Fig. 1A). This device inhibits erection by physically restricting tumescence and apparently

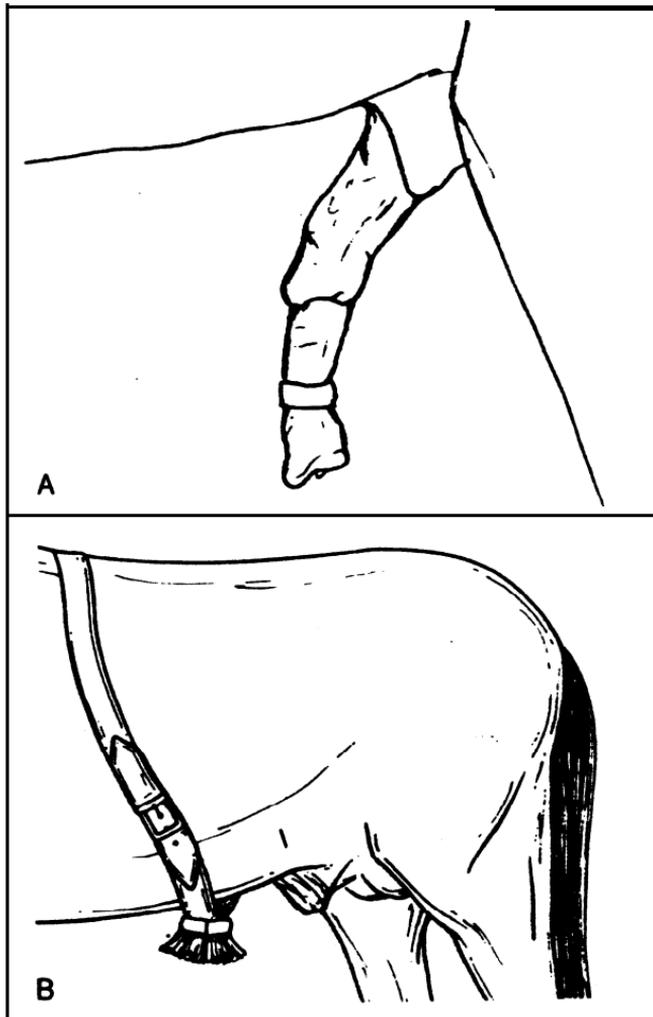


Figure 1. A, Stallion ring and B, brush.

causing discomfort. The "brush," a stiff-bristled brush strapped to the belly, employs similar learning principles to discourage masturbation in stallions (Fig. 1B). Abrasions and scarring of the penis resulting from such devices may also inhibit erection. Figure 2 is a photograph of a typical stallion-ring-induced band of scar tissue encircling the shaft of the penis of a stallion.

To test the effects of such negative experiences on sexual behavior of stallions, we subjected mature, sexually active pony stallions to aversive conditioning with a paradigm analogous to the conditions used to discourage sexual behavior in stallions.²⁵ 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 mares, we have produced stallions with mare-specific sexual behavior dysfunction.

The stimulus mare is another important factor that can affect stallion behavior. Most stallions will respond or can -be trained to respond adequately to a suboptimal stimulus animal or even a breeding dummy mount mare. For most stallions, however, a mare in strong natural estrus elicits a stronger sexual response than a breeding dummy or an ovariectomized stimulus mare. The important visual or olfactory signals accounting for the difference in response remain a matter of speculation.



Figure 2. Stallion ring scar.

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. Incidence of fertility-limiting behavior problems in stallions in general remains difficult to estimate. We have recently reviewed our stallion behavior in-cases (Georgia and Philip Hofmann Center for Animal Reproduction) and telephone consultations over a 5-year period. Behavior-related fertility or management problems comprised in excess of 25% of the stallion cases throughout the period studied. Table 2 summarizes the types of problems seen in the most recent 250 stallion behavior cases referred to our clinic (1986 to 1991). In this sample, the breeds, ages, and performance types closely reflect the breeds and performance types seen in our general hospital population.

Sexual Interest or Arousal Problems

Sexual behavior problems and dysfunction in the horse are often referred to as *libido problem*. This term best fits one type of problem, the slow breeder. Slow arousal and awkward approach occur frequently in young or novice breeding stallions. These *animals, although interested, appear confused and fearful when first presented to a mare. Such stallions may fail to show any noticeable sexual interest in estrous

Table 2. SUMMARY OF 250 CASES OF STALLION SEXUAL BEHAVIOR DYSFUNCTION

Sexual interest/arousal problems	50%
Slow novice (26%)	
Experienced breeder (12%)	
Unruly, over-aggressive breeder (12%)	
Erection dysfunction	5%
Inadequate erection (3%)	
Loss of erection upon insertion (1%)	
Premature glans flare (1%)	
Mount dysfunction	6%
Ejaculatory dysfunction	25%
Anejaculation (15%)	
Premature ejaculation (1%)	
Urine in ejaculate (9%)	
Fertility-limiting general behavior problems	12%
Self-mutilation (5%)	
Savage aggressiveness (4%)	
Hyperactive or severe stereotypy (3%)	
Sexually aggressive during performance	2%

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. Although most stallions quickly gain confidence, especially after even one successful copulatory experience, others may take weeks or months to achieve acceptable breeding performance. Managers often find such slow-starting stallions objectionable and frustrating to work with. Unfortunately, it is during this critical time that impatience and rough handling appear to complicate and prolong sexual behavior dysfunction. Unnecessary punishment often leads to profound disinterest in breeding. The veterinarian probably can best help by offering advice that many stallions with exemplary adult breeding behavior started out as slow or "shy" breeders. Based **on** research and clinical experience, we estimate that about 5% to 10% **of stallions show some difficulty when first breeding.** Although most such stallions improve to normal levels of sexual arousal and response within 1 to 5 days of traditional training, some require **weeks.** Most slow-starting novice breeders can be trained on the farm and do not require a specialized behavior modification facility or pharmacologic aids.

A particularly curious syndrome of anomalous behaviors involves what has been interpreted as bonding of stallions to humans rather than to horses. In addition to the common problems of awkward approach, slow interest, and lack of confidence seen in many young or novice stallions, some stallions show marked disinterest in mares and unusual attachment to humans. In the presence of a mare, these animals appear more attentive to the activity of the human handlers or observers than the mare. If encouraged or forced to approach a mare, the animal appears fearful, bored, confused, or resistant. In some instances, these stallions exhibit juvenile responses and a subordinate posture in response to mares. Mares that show strong proceptive responses to other stallions may respond to these stallions with aggressive or ambivalent behavior. These animals either fail to respond sexually to a mare while in the presence of a human or respond sexually only to humans. For example, sexual arousal and erection may occur only if the stallion is allowed to lick the hand or nuzzle a human handler. Some of these animals were hand-reared orphan foals.

Mature, experienced breeding stallions may also experience periods of inadequate interest or response to mares. After long periods of normal, consistent sexual performance, some stallions rather abruptly develop aberrant behavior, including slow breeding or ejaculatory failure. **It** is not uncommon for these stallions to become abnormally aggressive toward mares or handlers. Such problems sometimes appear to develop secondary to pain or injury. Diminished libido may persist long after the injury and physical pain appear to have been alleviated. Although rare, there are stallions that are consistently slow breeders when bred on a frequent schedule but show normal arousal and response if given long periods of sexual rest between breedings. Perhaps the most frustrating sexual behavior problem is the stallion that performs inconsistently for no discernible reason. The extreme case

is the stallion that breeds with gusto one day and fails to show interest the next. Occasionally, stallions show a preference or aversion for certain mares, handlers, or locations. Many stallion managers are able to facilitate breeding success of such stallions by accommodating preferences or aversions.

A common sexual behavior problem involves the stallion with seemingly uncontrollably high libido. Specific problem behaviors include charging the mare, refusal to stand for washing or examination of the genitals, or wheeling and kicking out at the mare or handler. In our experience, most of these problems are the result of inadequate or improperly applied discipline. We have recently shown experimentally that almost any stallion can develop unruly, dangerous breeding habits within 2 weeks of simple improper handling. Fortunately, most can be brought under control again with consistent, firm, judicious handling. We have found the most efficient behavior modification strategy for dangerously unruly stallions is to bring the horse under control using an expert stallioner, and then provide training of the handlers with the horse on the home farm.

Specific Erection, Mounting, and -Ejaculation Dysfunction

Some stallions show normal interest, arousal, and response but fail to complete copulation in association with specific mounting, erection, or ejaculation difficulties. In some cases, there may be problems with mounting, intromission, coupling, thrusting, or maintenance of erection during thrusting. 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 found in some stallions with ejaculatory difficulty is dismount during or before ejaculation. Specific erection, mounting, and ejaculation problems and their treatment are discussed in detail in the article on Ejaculation: Physiology and Dysfunction elsewhere in this issue.

Other Fertility-limiting Behavior Problems

In contrast to the more simple unruly behavior just described is the truly savage and aggressive behavior of some stallions. Often well-mannered and easy to handle most of the time, these stallions occasionally savage another horse or a handler. Specific behaviors include charging with bared teeth and lowered head, picking the handler up by the shoulder or waist, or attacking with forelimbs. Savage stallions, if kept, usually repeat such episodes. Some have been safely bred under bull stud conditions, where the physical facility and handling protocol are designed to safeguard the human handlers.

Breeding stallions may exhibit stereotypies or stable vices that,

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 frequently occur in combination. A number of activities may be performed in a ritualistic sequence. Many stallion vices involve rhythmic noise. The animal may scream or **roar** in association with the activity. As with stable vices in general, stallion vices seem to be associated with confinement and inactivity. The problems sometimes worsen as exercise decreases and may diminish if toys or stall companions, such as goats or rabbits, are provided.

Self-mutilation syndrome is an extreme, often life-threatening or fertility-limiting stereotypy seen in horses. The **animal** may compulsively nip, bite, or tear at his 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. Some of the notorious **self-mutilating** stallions 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 is observed. Self-mutilation is not limited to confined animals. In most cases, emergence of **self-mutilation** is post-pubertal, and it may subside with castration. **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 because the animal compulsively struggles to perform the activity or initiates an alternate technique of **self-destruction**.

Evaluation and Therapy

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 pony to horse. But there is little valid evidence to either support or refute the hypothesis that certain individuals carry a genetic predisposition to sexual behavior dysfunction. On the other hand, experience no doubt plays a role in stallion behavior dysfunction, either as the primary cause or secondary factor. Frequently, an owner relates the stallion's problem to a particular experience, such as a kick from the mare, a beating by the handler, or an accident in the breeding shed. Clinicians who work with stallion behavior dysfunction typically suspect that the majority of sexual behavior dysfunction in stallions involves handling

or management factors. It has been our practice to discuss these two issues with clients before initiating therapy.

In evaluating sexual behavior dysfunction in stallions, it is useful 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, postures, and attitude and 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 aspect 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 delineating the problem. It is sometimes useful to observe the stallion in the home breeding environment under the farm's standard handling procedures.

A checklist of responses based on Table 1 (section on normal response) is useful in identifying missing or unusual elements of precopulatory and copulatory behavior. For example, it is not usual behavior for a stallion to **yawn**, 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. Head-shaking, pawing, kicking, and severe biting are presumed to be signs of frustration.

Behavior Modification

Some problems resolve with simple changes implemented during the evaluation. We find a large proportion of cases improve with simple, patient handling. 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, capable 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 are minimal. Although the specific procedures vary, there are some general principles to consider when retraining a stallion.

In general, the most natural breeding conditions possible yield the most efficient progress. Pasture breeding in a large open area is **an** excellent therapeutic approach for a slow novice stallion. Exposure to an older, solicitous mare facilitates improvements in some slow novice stallions. After only a few successful pasture breedings, even very shy novice breeding stallions will make the transition to in-hand breeding. If pasture breeding is not an option, exposure to an estrous mare in an adjacent stall may be helpful. Similarly, working in an outdoor breeding arena may be more likely to facilitate sexual behavior than working

indoors. Minimal breeding equipment and procedures may be better for some stallions **at** first.

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. A blindfold or blinders can, in some instances improve sexual behavior of a stallion; however, in some instances, a muzzle or blinders appear to suppress sexual response. Care should be taken to accustom the stallion to the blinders before trying them in the breeding situation.

One of the early goals of training, 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.

A quiet mare showing strong natural estrus is probably the best choice of stimulus mare. If the stallion shows little interest in a particular mare, others should be presented. Some stallions show greater interest if allowed to "choose" a mare from a group if more than one stimulus mare is available in the breeding area. In some instances, a more feisty, active mare elicits a stronger stallion-like response than a docile mare. The mount mare should be of an appropriate size for the stallion. A breeding dummy mount may be useful for the stallion that seems afraid of mares. The footing should be solid and should preclude 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 training. Whenever possible, positive reinforcement should be used instead of punishment. Special care should be taken not to jerk a stallion on the lead shank unnecessarily or pull it down from mounting a mare. We view mounting without an erection as a normal behavior that should not be discouraged in a novice stallion. Once a stallion becomes confident, this behavior can be gradually eliminated. An ill-disciplined stallion can be worked on the ground outside the breeding area to establish basic handling rapport until the stallion will stand, move forward, and move backward with gentle voice commands or gestures.

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

"Voyeur" Effect

For reasons not well understood, some slow breeders show marked improvement when exposed to breeding activity of other horses. On some farms, this is accomplished quite efficiently by placing the stallion in a stall within sight of the breeding area. Sight of another stallion may stimulate inter-male aggression, so care should be taken to avoid the possibility of fighting.

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 have adverse effects on **spermatogenesis**^{3, 4, 34} and exogenous androgen may increase aggression without improving sexual behavior (McDonnell SM, unpublished data). Presently, androgen therapy is recommended as a last resort only in stallions with low endogenous androgens whose libido is so low that ejaculation is unlikely without treatment. Before initiating androgen treatment, low endogenous levels should be confirmed in two or three samples taken over a **1- or 2-week** period. Also, a gonadotropin stimulation test can be used to evaluate the integrity of the pituitary **gonadal** axis and the ability of the interstitial cells to respond. Circulating androgens typically double within 1 hour following challenge with **GnRH** (McDonnell SM, unpublished data, 1991).

Gonadotropin-releasing Hormone

Gonadotropin-releasing hormone has been shown to influence male sexual behavior via **endocrine** as well as direct central nervous system effects. Experimental evidence indicates that **GnRH** administered in a pulsatile fashion (25 μg subcutaneously every 3 hours) enhances sexual behavior?²⁹ Clinically, we use a **GnRH** treatment regimen consisting of 50 μg **GnRH** (Cystorelin, CEVA, Overland Park, KS) subcutaneously 2 hours and again 1 hour before breeding to enhance sexual arousal of stallions. This has been judged helpful in increasing sexual interest and arousal of slow starting novice stallions and mature breeding stallions that have "soured." We also find it useful as an aid in "super-arousing" stallions with specific erection or ejaculation difficulties.

Anxiolytics

Anxiolytic compounds have proved useful in stallions with experience-related suppressed sexual interest or arousal?²⁶ The most

widely used has been diazepam. Slow novice breeding stallions, particularly those exhibiting signs of anxiety, often respond favorably with a single treatment of diazepam (0.05 mg/kg up to 20 mg/animal, slow IV, 5-7 minutes before breeding). After one ejaculation, libido of the novice usually remains adequate, and further treatment is not required. Diazepam also has been useful for treating specific aversions, for example, to an artificial vagina, a specific handler, a breeding dummy mount, or a particular mare. Experimentally, we have found a transient adverse effect of novel environment on sexual arousal in stallions, which can be blocked by diazepam treatment.²⁶

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 hind limb injuries, which are not uncommon among retired racing and performance stallions. We typically use oral phenylbutazone (1 g b.i.d.) for a minimum of 10 days. Work in our laboratory indicates no adverse effect of this treatment on semen or general health.

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