Flehmen

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About This Column

Behavior problems in horses are often not given proper attention. While most veterinary practices are necessarily geared toward the medical aspect of care, there are many opportunities in which behavior awareness can benefit the horse, the owner, and ourselves. This column acknowledges the importance of behavior as part of veterinary medicine and speaks practically about using it effectively in daily practice.

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The exhibition of flehmen (Figures 1 and 2) is an equine behavior that causes clients to ask "why." For example, a practitioner may be busy performing a clinical procedure on a horse that shows flehmen, prompting the client to say, "See him laugh. Why does he do that?" This column helps provide the short or long answer, depending on the client's interest.

BACKGROUND

Flehmen in horses was first described by Schneider in 1930.[1] Popularly called the *horse laugh*, it is a visually distinctive behavior in which the upper lip is elevated due to contraction of the levator labii superioris, nasolabial, caninus, and lateralis nasi muscles. In addition, a horse usually extends its neck and raises its head. The inhalation that occurs during flehmen is not obvious to a casual observer but facilitates the movement of molecules into the vomeronasal organ (VNO)—a specialized chemosensory organ that communicates with the ventral nasal meatus in horses. The VNO was once called *Jacobson's organ*, after Ludwig Jacobson, who first described it in 1813.[2]

The VNO is present in most mammals; however, its exact form and structure vary. Depending on the species, the organ is connected with the mouth, the nasal passages, or both. Although the organ's role in chemosensory communication has been studied in several species, vomeronation[a] does not appear to have a specific, discrete function. However, in mammals, substantial evidence supports the involvement of vomeronation in various aspects of physiologic and behavioral reproductive development. Species with a direct connection between the VNO and the mouth, such as dogs, commonly lick a substrate before showing flehmen or exhibiting equivalent, species-specific behavior. However, horses typically do not do this, which is consistent with the VNO not being connected to the mouth. (The behavior that dogs use to introduce chemicals into the VNO is commonly called *teeth-chattering*; in cats and pigs, it is called *gaping*.) The vomeronasal nerve transmits information from two different types of receptor cells in the VNO to two different parts of the accessory olfactory bulbs of the brain. The presence of a functional VNO in humans is controversial.[3]

OCCURRENCE

Flehmen occurs most commonly in stallions. However, mares and foals of both sexes also show flehmen. A function commonly attributed to flehmen is detection of estrus in mares. However, stallions presented with urine or feces of estrous or nonestrous mares do not show flehmen more or less frequently depending on the mare's

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[a]Sensory perception of environmental molecules via the VNO, typically accompanied by flehmen.

Figure 1. Side view of a colt showing flehmen. (Reprinted from Crowell-Davis S. Equine essentials: understanding foal development and its relevance to raising orphaned foals. *Vet Tech* 2008;29(2):116-122; with permission.)

Figure 2. Front view of a colt showing flehmen. The incisor teeth and gums are exposed.

estrous status.[4,5] In contrast, bulls do show a higher rate of flehmen in response to estrous cow urine than to nonestrous cow urine. Bulls also show flehmen for longer periods of time in response to estrous urine compared with nonestrous urine.[3] Because a mare urinates much more frequently when she is in estrus and a stallion does not appear to be able to discriminate between estrous and nonestrous urine, it appears that flehmen facilitates chemosensory priming of stallions for reproductive behavior rather than being an immediate component of sexual behavior.[5]

Differences in flehmen between males and females occur in young foals. During the first 3 months of life, colts exhibit flehmen more frequently than do fillies. They also perform more flehmens per incident (a series of flehmens exhibited sequentially at the same site) than do fillies.[6] During the daylight, Welsh pony colts exhibit flehmen approximately once per hour, whereas Welsh pony filly foals exhibit flehmen approximately once every 5 hours. Overall, fillies exhibit flehmen more frequently than do adult mares. However, like stallions, colts presented separately with estrous and nonestrous mare urine during each of the first 4 weeks of life and again during the second, third, fourth, and seventh months of life did not exhibit any difference in frequency of sniffing, latency to flehmen, or frequency or duration of flehmen.[7] In contrast to field studies in which colts showed flehmen much more frequently than did fillies, there was no difference in response between colts and fillies in a test situation conducted by Weeks and colleagues.[7] This may be because there may not be sufficient stimulation in a test situation in which chemical cues occur in isolation without visual cues, such as witnessing urination. In stallions, blocking vision decreases the frequency of flehmen.[8]

In response to sniffing amniotic fluid, fetal membranes, and their newborn foal, mares exhibit a peak in showing flehmen during the first hours after giving birth. Flehmen can occur in a variety of contexts in both genders and at all ages. While it occurs most commonly after another member of the herd urinates, a horse that has just urinated may also exhibit flehmen. While flehmen is usually exhibited without specifically moving the nostrils close to urine, the nostrils are sometimes placed immediately above grass or earth that has recently been wetted by urine, with repeated flaring of the nostrils indicating sniffing. Horses rarely stick their nose in a puddle of urine.

Many flehmens are exhibited after nosing various objects or grass on which urination has not recently occurred. It has not been determined whether these flehmens are in response to older urine or to volatile substances coming from plants, the earth, insects, or other sources. Flehmen is also often exhibited for no apparent reason (e.g., a horse may be walking in a pas-

ture and show flehmen without another animal urinating nearby or without moving its nose close to the grass). Horses often exhibit flehmen after sniffing feces, and stallions both sniff and show flehmen significantly more in response to mare feces than to feces of other stallions. Thus, stallions appear to be able to differentiate sex based on chemical information in feces.[5]

THE OLFACTORY EPITHELIUM AND THE VOMERONASAL ORGAN

While the sense of smell is subject to classical conditioning, research to date suggests that the VNO appears to be involved in chemical sensation of unconditioned stimuli (i.e., the response involved in triggering flehmen is innate, not learned). In contrast, responses to olfactory stimuli by the main olfactory epithelium are based on the conscious perception of odors and are subject to classical conditioning. Therefore, various odors mediated by olfaction can become conditioned stimuli. Pheromones (i.e., substances secreted by an individual and detected by another individual of the same species, in which a specific reaction occurs) appear to be the main chemicals detected by the VNO.[9] However, the VNO has also been shown to be involved in detecting nonpheromone chemicals, and the main olfactory epithelium has also been shown to be involved in detecting pheromones.[10,11]

ORPHANED FOALS

Showing flehmen and the functional significance of the VNO are particularly important in orphaned foals. While it has not been definitively proven, evidence to date suggests that exposure to urine may be important for normal physical and sexual maturation in colts. Therefore, it is important, especially for orphaned colts that may be kept as stallions, to expose colts to urine during their early development, particularly the first 3 months of life, when the rate of showing flehmen is especially high among colts living in a natural herd environment. Deliberate exposure to urine may not be necessary if the colt is being raised with other horses, which is ideal in raising an orphan. However, if other horses of suitable temperament are not available as companions for a colt, soaking rags in the urine of other horses and hanging them in the stall or paddock where the colt is being raised may prove beneficial.

Key Points

- The horse laugh, more appropriately referred to as *flehmen*, is a behavior in which the upper lip is strongly elevated, exposing the gums and the incisor teeth.
- When a horse shows flehmen, it inhales, drawing molecules into its vomeronasal organ. Information is then relayed to the accessory olfactory bulb via the vomeronasal nerve.
- Frequent urination by estrous mares stimulates frequent flehmen in stallions, possibly serving as a form of chemosensory priming for reproduction.
- Flehmen is exhibited by horses of both sexes and all ages, including geldings.
- Flehmen occurs most commonly in intact stallions in the presence of an estrous mare. In this case, both visual cues and chemical cues affect the incidence of flehmen. Mares most commonly exhibit flehmen in the presence of a neonate and amniotic fluid.

CONCLUSION

Showing flehmen has nothing to do with a horse's putative sense of humor. Instead, it facilitates the function of the VNO—a specialized sensory organ that is critical to chemical communication in horses.

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