

Understanding and Implementing Principles of Learning in the Equine Veterinary Practice

Robin Foster, PhD, CAAB, CHBC

Author's address: University of Puget Sound, Department of Psychology, 1500 N. Warner, CMB 1046, Tacoma, WA 98416; e-mail: rfoster@pugetsound.edu © 2017 AAEP.

1. Introduction

Veterinarians who work with horses have a higher risk of serious injury than firefighters, police officers, and other civilian occupations, according to a recent study in the United Kingdom.¹ Equine veterinarians suffer approximately eight injuries over their career, and the primary cause is from a kick or strike by the horse. Behavior problems during veterinary care are common; a horse that is unfamiliar with a veterinary procedure, has had a negative experience, or is frightened or injured can take longer to examine and cause a great deal of damage. Practices that reduce behavior problems in the horse will help mitigate the risk of injury to veterinarians.

A limited understanding of learning principles and science-based behavior modification techniques may be linked to the high incidence of injury.² A survey of veterinarians in the United Kingdom found that most lacked education about and did not use methods based on learning principles and science-based behavior modification methods; instead, dangerous situations were generally managed with chemical or physical restraint. Although necessary in some situations, restraint can provoke even more dangerous escape responses and does little to resolve behavior problems, which

requires addressing the horse's emotional state and the environment.

Handling methods that promote calm emotions and prevent stress, anxiety, and fear are recommended by the American Veterinary Society of Animal Behavior.³ Positive veterinary care practices can increase caregiver safety and animal welfare,⁴ as well as improve diagnosis and treatment outcomes; when a patient becomes fearful or anxious during an exam, sympathetic arousal can interfere with accurate diagnosis.³ Even pain-free procedures can cause discomfort if the animal is tense, or if punishment and restraint are used to control behavior. Fear and anxiety negatively affect future health care as well; even one unpleasant veterinary experience can generalize to subsequent visits, and when an animal has a history of fear and behavior problems the owner is less likely to call the veterinarian.

The use of behavior modification techniques based on principles of learning can reduce fear and problem behaviors^{5,6} and promote positive veterinary care.⁴ Low-stress handling and nonaversive behavior modification methods have been widely adopted among veterinary professionals who work with small animals^{4,6} and large captive land and marine mammals.^{7,8} Similar strategies can be ap-

NOTES

plied to horses to improve caregiver safety, health care efficiency and outcomes, as well as animal welfare.^{5,9} In fact, it can be reasonably argued that maintaining positive interaction is even more important for larger and potentially more dangerous species. The following sections describe positive methods based on well-tested, scientifically sound principles of learning and behavior modification and their application in equine veterinary practice.

The Cycle of Anxiety and Avoidance: How Horses Learn to Misbehave

Fear and anxiety are the root cause of behavior problems with veterinary care, including not standing still for examination; barging or pushing; reluctance to enter the exam room, stocks or trailers; bolting or pulling away when led; and biting, kicking, or striking. These behaviors are often inadvertently reinforced by the release of pressure (negative reinforcement) and will be repeated. Anxiety often begins with normal wariness about an unfamiliar object or situation. If the horse then also experiences stress or pain, it will learn to anticipate the object or situation as a potential threat, and also learn to fear anything associated with it, a process called fear conditioning. Horses, as a prey species, are especially adept at this type of learning. In veterinary care, things associated with an unpleasant procedure might include the location, veterinarian, or equipment. For example, a horse that experiences distress or discomfort during an injection may become anxious simply at the sight of the syringe because it is reliably associated with the injection.

Individual horses respond differently to various stressful situations and levels of discomfort. Most cope with aversive conditions well, but others show extreme reactions. On one extreme are horses that shut down and withdraw; on the other extreme are horses that attempt to escape, and if prevented from doing so, may become aggressive. Fear-based defensive aggressive responses are dangerous; they almost always remove, terminate, or postpone the procedure, if only briefly, and are thus inadvertently reinforced and will be repeated. The cycle of anxiety and avoidance (Fig. 1) will persist if a horse is put back into the same situation in which the fear and problem behavior previously occurred.

Managing behavior problems with punishment and/or increased physical restraint is more likely to escalate than to break the cycle of anxiety and avoidance. Punishment and physical restraint add to the horse's discomfort and anxiety. Restraining devices, such as a lip or ear twitch, stud chain, or antirearing bit, are conventionally used to control the horse's behavior during veterinary care.¹ It is also common practice to punish unwanted behavior by jerking on a halter or chain, waving a whip or rope, striking the horse, or yelling sharply, despite recommendations against the use

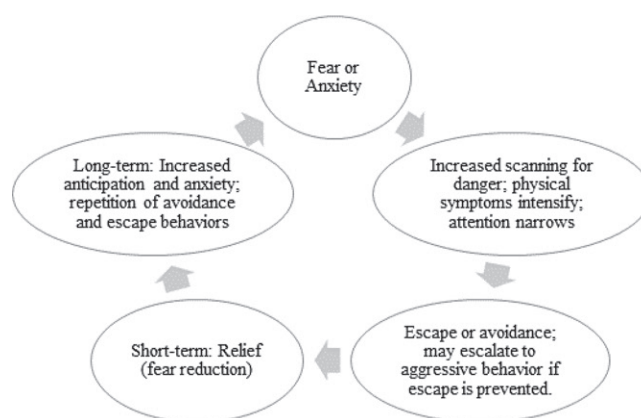


Fig. 1. The cycle of anxiety and avoidance.

of punishment by the American Veterinary Society of Animal Behaviorists.¹⁰

Behavior Modification: Preventing and Reversing Problems

The goal of behavior modification in veterinary care is to reduce both the underlying fear and unwanted behavior, as well as to strengthen positive emotions and compliance. A behavior analysis of the problem helps identify learned causes as well as other possible contributing factors such as physical pain, neurological and metabolic conditions, and infectious disease.⁵ Identifying the reasons for the fear and anxiety is an important first step, and behavior can be improved by eliminating or treating them. When a learned cause is suspected, evidence-based behavior modification techniques can help meet behavior-change goals.^{4,5,9,11} Selected techniques particularly useful to veterinarians who work with horses are described in the following sections.

2. Monitoring for Relaxation and Recognizing Early Signs of Fear and Anxiety

Maximizing a calm emotional state and minimizing fear and arousal requires keeping the horse as calm as possible, and monitoring body language for relaxation and early signs of anxiety. When a horse is relaxed, unwanted behaviors are less likely to occur, and the long-term effectiveness of behavior modification is improved. Animals learn best at mild to moderate levels of sympathetic arousal—when they show attention, without tension; at higher levels of arousal the brain is primed for defensive action and fear conditioning. A horse's facial expressions,¹² posture, and muscle tension offer a window into its internal emotional state and provide a tool for assessing the animal's level of arousal, anxiety, and attention (Fig. 2).^{13,14}

3. Creating a Relaxing Environment

A familiar axiom among behaviorists is "the ABC's of learning," which is an abbreviation for antecedents, behavior, and consequences. Arranging ante-

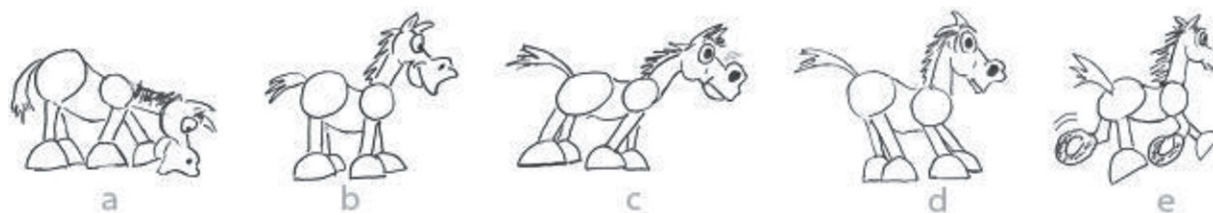


Fig. 2. A cartoon illustration of the equine defensive action sequence. Responses having low arousal and low perceived threat are on the left, with increasing arousal and greater perceived danger on the right. Response categories include (a) relaxation, (b) attention, (c) tension (d), avoidance, and (e) flight.

cedents is a powerful and effective strategy for maintaining an animal's positive emotions and calm demeanor. Antecedents refer to any cues in the environment that predict whether something pleasant or threatening might occur, or if a response will be rewarded or punished. If the experience is repeated, the horse learns to anticipate the event and will start to react sooner, in response to these antecedent cues.

Horses often react to cues associated with veterinary care because they are distinctive, ritualized, and predictable. The horse is led to a particular location where the procedure takes place, an ambulatory veterinarian truck is parked nearby, the veterinarian sets up special equipment, and the exam is carried out in a fixed order. This means that a horse can readily learn to anticipate a veterinary visit and respond long before the exam or procedure begins. Previously neutral objects will elicit fear if they have been associated with pain or discomfort, and through the process of generalization, other similar stimuli can also begin to elicit fear, anxiety, and problem behaviors. Alternatively, creating a positive association with the veterinary experience promotes calm emotions and behavior.

The location where the veterinary exam takes place is a common trigger for anxiety if a bad experience previously occurred in that area. The horse may be more relaxed if the exam is conducted in a different location, particularly one previously associated with positive experiences. Conducting procedures in a quiet environment with few distractions, minimizing noises linked to specific procedures—for example, by using silent clippers—and limiting the use of bright lights, are recommended.⁶ Emotional states are socially facilitated (contagious) in horses, so having a relaxed, familiar horse nearby can help calm some nervous horses. Conducting veterinary exams or procedures in the horse's stall is not recommended; this area should be reserved as a sanctuary or "safe zone" where nothing unpleasant happens.

If a horse is overly fearful or anxious, or if its behavior is dangerous, the veterinary exam can be broken up into multiple visits, and nonessential procedures postponed for a later time.⁶ In some cases, anxiety-reducing medications and products can im-

prove behavior in the moment, as well as increase the effectiveness of behavior modification.

4. Habituation and Systematic Acclimation to Novel Objects and Situations

The initial veterinary experience can have a profound and lasting effect on future behavior. At this time, the horse's reactions to unfamiliar people, situations, sensations, and equipment are unlearned and automatic. Habituating the horse to being handled and examined is an important goal of positive veterinary care. Habituation refers to a decrease in the strength of a response with repeated exposure to the object or experience, and will occur if a situation is nonthreatening. Potentially fear-inducing novel objects, situations, or mildly aversive veterinary procedures can be introduced gradually through the process of systematic acclimation.

If the potentially threatening situation is too strong, persists, or intensifies, then sensitization might occur; the horse's senses become heightened and skeletal muscles mobilize for defensive action. In horses, defensive behaviors escalate in a predictable action sequence that includes orient, freeze, fidget, avoid, flee, and fight (Fig. 2). The sequence reflects increasing sympathetic arousal and cognitive capacity for fear conditioning. Sensitization can be avoided by monitoring body language and arranging the situation to reduce levels of arousal and anxiety, but prevention is the best medicine. Taking a proactive approach with young horses by providing positive, mildly stressful experiences will help build resilience to veterinary handling, equipment, and procedures.

5. Reducing Fear and Problem Behaviors with Systematic Desensitization

Systematic desensitization works to overcome a horse's learned fear of an otherwise-harmless object or situation through gradual, progressive exposure to the feared stimulus. The stimulus is presented at a low intensity and/or short duration, while the horse remains calm and without triggering fear or defensive behavior. Through repeated nonthreatening experiences, the negative emotions and problematic behavior decrease. The intensity and duration of exposure to the feared object or situation

is gradually increased, typically over multiple sessions, and if the horse should display stress-related or defensive behaviors at any time during the process, the intensity and duration of exposure is reduced. Systematic desensitization is often combined with relaxation techniques and counterconditioning.

6. Counterconditioning

Counterconditioning is a treatment for phobias and conditioned fears in which the individual learns an incompatible response when presented with the feared but otherwise-harmless stimulus. It works by creating a new association between the feared stimulus and a pleasant stimulus. The pleasant stimulus elicits a positive emotion and relaxed response, which replaces the fear and withdrawal behaviors. After repeated pairings between the feared and pleasant stimuli, the previously feared stimulus comes to predict a rewarding rather than an unpleasant event. In practice, counterconditioning is typically used in conjunction with gradual exposure to the feared stimulus (systematic desensitization).

Counterconditioning can be applied broadly to veterinary handling, procedures, restraints, and equipment.⁴ For example, a horse with a learned fear of injections may withdraw from the syringe by becoming tense, raising its head, and stepping backward. Although the syringe is harmless, it has become aversive through past association with a distressing or painful experience. During counterconditioning, the syringe would be paired with and predict something pleasant, like a treat placed in a dish on the ground, such that when the syringe is presented, the horse remains calm, drops its head, and takes a step forward for the treat. Calm emotions and head dropping thus become the horse's newly conditioned response to the syringe.

By definition, counterconditioning is a classical conditioning process that involves pairing the feared stimulus and the pleasant stimulus at the same time. For example, with a needle-shy horse the syringe (the feared stimulus) might be held against the horse's neck for 10 seconds, and at the same time the horse would get treats (the pleasant stimulus). The treats would stop when the syringe is removed. A recent study found, however, that a modified counterconditioning technique was more effective and resulted in a lower risk of relapse; the modified technique involves first presenting the feared stimulus, and then offering the reward only after the animal performs a desired behavior.¹⁵ For example, modified counterconditioning could be used in a needle-shy horse. The syringe would be held against the horse's neck for 10 seconds, and treats presented only if the horse stands calmly (the desired behavior).

Distraction with pleasurable activities can also help to promote relaxation by shifting the horse's attention away from the veterinary procedure.

Engaging the horse in a previously trained, familiar, positively reinforced task such as touching its nose to a target for a treat reward¹⁶ will divide attention, reduce stress, and create a positive association with the veterinary procedure. Scratches or massage are relaxation techniques that can also be used as distracting activities.¹⁷ For example, a gelding scratched on the belly with a stiff brush when his hoof was trimmed immediately stopped fidgeting and pulling his leg away. Pharmacological agents and supplements such as calming pheromones or a sedative administered orally or rectally can also help reduce anxiety before veterinary procedures.

7. Overshadowing

Overshadowing¹⁸ is a technique used to attenuate fear and related problem behaviors that can be applied to horses. The horse is lead forward with determination, as if going somewhere, or back and forth a few steps using forward and reverse rein cue, and at the same time the feared stimulus is introduced. The horse should be first trained to step forward and backward on light rein pressure. The movement of the horse distinguishes overshadowing from other exposure methods for reducing fear-based problem behaviors.

Overshadowing has been used in veterinary care on horses that are fearful during injections and when clipped. Reports about its effectiveness at reducing problem behaviors and decreasing sympathetic arousal have been primarily anecdotal, and empirical confirmation is lacking. Whether overshadowing works via habituation, desensitization, flooding, or some other mechanism is not clear. Restraining devices, such as an anti-rearing bit, are often used to direct the horse's movement and simultaneously prevent unwanted responses. Because the horse is moving forward or stepping back and forth while being injected or clipped, implementing overshadowing requires a skilled handler to avoid flooding.

8. Avoid Flooding

Flooding refers to exposing the horse to a high intensity of the feared object or situation until the unwanted response disappears. At the same time, the horse is typically confined or restrained to prevent it from escaping or even performing the problem behavior. One example of flooding would be a horse with fear of hoof trimming and severely overgrown feet who is placed in stocks with its hoof securely tied up with rope (response prevention) to use an angle grinder on it (high intensity of the feared stimulus). It is called flooding because the horse is overexposed to the feared stimulus and "flooded" with fear and anxiety. In theory, flooding should lead to extinction of the fear and defensive behavior, and break the cycle of anxiety and avoidance. In practice, flooding is distressing or even traumatic, leads to behaviors that are unsafe for both horse and caretaker, and can worsen the fear

Table 1. The Four Quadrants of Operant Conditioning

	Reinforcement Increases Behavior	Punishment Stops Behavior
Positive (+) Something is added	R+Positive Reinforcement <i>Behavior increases because it results in something pleasant being added.</i> <i>Example: The horse drops his head because he gets scratched on the neck or withers.</i>	P+Positive Punishment <i>Behavior stops because it results in something unpleasant being added.</i> <i>Example: The horse stops raising his head because the lead rope is yanked sharply.</i>
Negative (-) Something is removed	R-Negative Reinforcement <i>Behavior increases because it results in something unpleasant being removed.</i> <i>Example: The horse turns her hindquarters away from the veterinarian because it delays having the rectal thermometer inserted.</i>	P-Negative Punishment <i>Behavior stops because it results in something pleasant being removed.</i> <i>Example: The horse stops pawing at the ground because she is ignored and does not get the attention she seeks.</i>

Operant conditioning refers to voluntary behavior that is shaped by its consequences, which are pleasant, unpleasant, or neutral. Reinforcement refers to behavior that leads to pleasant consequences and is repeated in the future, whereas punishment refers to behavior that leads to unpleasant consequences and is inhibited in the future. An animal's actions also add or remove something from the environment. When something is added the mathematical notation "positive" is used, and when something is removed or subtracted the mathematical notation "negative" is used. This table is the definition and example of each of the four quadrants of operant conditioning (positive reinforcement, negative reinforcement, positive punishment, and negative punishment).

and problem behavior, especially if the horse breaks free from the restraint. The use of flooding in equine veterinary care and training is not recommended.^{5,18}

9. Reinforce Desired Behaviors and Avoid Reinforcing Unwanted Behavior

Strengthening desired behaviors and decreasing problem behaviors using operant conditioning often calls for a two-pronged strategy. One prong involves positively reinforcing (Table 1) desired behavior, such as standing calmly or offering a hoof. Sometimes the desired behavior must be shaped first, by progressively rewarding closer and closer approximations of the goal behavior. The second prong is to stop reinforcing problem behaviors, which often persist because they are accidentally reinforced. Any behavior that delays a procedure, even briefly, will be negatively reinforced (release of pressure; Table 1) and repeated in the future. Ideally the environment has already been set up to minimize fear and problem behaviors, but it is important to be prepared if they occur.

The needle-shy horse offers a useful example of how the two prongs of differential reinforcement can be applied. A needle-shy horse often barges forward as the veterinarian approaches with a syringe in hand. When the person takes a step back to get of the way, the barging behavior is reinforced because the horse gains some distance from the feared syringe and delays the injection. Instead, the person should keep the syringe in a constant position, moving with the horse as it steps forward, and then remove the syringe only after the horse stops moving. Doing this will reinforce the desired behavior of standing still, but not the unwanted behavior of moving away. This example incorporates two effective strategies. First, the reinforced calm behavior,

standing still, cannot occur at the same time as the problem behavior, barging forward; this procedure is called differential reinforcement of incompatible behavior. Second, the desired behavior is a replacement for the problem behavior because it leads to the same reinforcing consequence, which is gaining distance from the feared syringe. Compliance can be further enhanced by applying a well-timed positive reinforcement/distraction in the form of vigorous scratching at the withers, similar to mutual grooming among herdmates¹⁷ or a food reward for standing still with the syringe in place.

10. Avoid Punishment

Punishment stops behavior by adding something unpleasant after the behavior occurs. The use of punishment in veterinary care is not recommended.¹⁰ As a behavior-change method it is reactive rather than prophylactic and applied only after the potentially dangerous problem behavior has already occurred. Punishment can suppress warning signs of escalating anxiety but not the explosive escape or aggressive behavior. It is also subject to misuse and can adversely affect the horse-human relationship because learned fear of the individual delivering the punishment may occur. Despite the concerns, in practice fear-based behaviors are often punished with forceful, painful, and confrontational methods, including yanking on a shank or bit; waving a whip or rope; yelling sharply at the horse; and striking the horse with a hand, boot, crop, or other object.

A major shortcoming of punishment is that it does not address the fear at the root of many behavior problems, and fear cannot be reduced through force or pain. Instead, punishment validates the horse's fear and adds to the unpleasant experience. The repeated use of punishment can also lead to an ex-

Table 2. Behavior Modification Recommendations for Positive Equine Veterinary Care

1. Read equine body language and facial expressions, to recognize relaxation and respond to early signs of fear, anxiety, and sympathetic arousal.
2. Work in a location that is comfortable for the horse and remove triggers of fear, anxiety, and defensive behaviors from the environment.
3. Habituate horses to new procedures and equipment; use systematic acclimation when introducing young or inexperienced horses to a potentially fear-inducing novel object, situation, or aversive procedure.
4. When the horse has a learned fear from a previous aversive experience, use systematic desensitization to gradually and progressively reintroduce the feared, but harmless, stimulus, while the horse remains calm.
5. Apply counterconditioning to replace fear-based emotions and behavior to veterinary procedures and equipment, with relaxed emotions and behaviors.
6. Overshadowing involves stepping the horse back and forth while at the same time presenting the feared stimulus, such that the directed movement "overshadows" and prevents the fear-based defensive response.
7. Avoid the use of flooding, which triggers fear and defensive behavior, and then uses force to prevent and suppress it.
8. Shape desired behavior and strengthen it with positive reinforcement; stop negatively reinforcing the problematic escape and avoidance behaviors.
9. Avoid punishing unwanted behavior using confrontational or painful methods, which increase fear, worsen behavior problems, and negatively affect equine welfare and the horse-human relationship.
10. Use the least amount of restraint required.

pansion of fear conditioning and a worsening of the problem behavior, with greater intensity and earlier onset as the horse anticipates not only the veterinary care, but also the unpleasant punishment. Even when punishment seems to work, fear may be internalized and the behavior problem only temporarily suppressed.

11. Use the Minimum Restraint Necessary

The use of low-stress handling and minimum restraint is encouraged in positive veterinary care.^{4,6} Veterinary professionals set an example for owners and the public about how to properly handle animals in a safe and humane manner. Developing good handling skills increases the safety of caregivers, and allowing the horse to cooperate voluntarily reduces stress by giving it greater control over the situation. Physical restraint plays a crucial role in managing horse behavior and providing support, and some methods of restraint are less stressful than others. For example, a lip twitch seems to have a short-term calming effect, whereas an ear twitch operates through pain avoidance.¹⁹ When restraint is paired with discomfort or distress, simply being restrained can become a conditioned trigger for fear, anxiety, and behavior problems. This effect can be mitigated by knowing how to apply and use restraints properly, as well as where to position oneself. If the procedure is painful, chemical restraint may be advised.

12. Conclusion

The equine veterinarian plays a critical role as an agent of change by practicing positive care, educating owners and trainers, and referring to behavior professionals. Implementing positive methods in a veterinary practice takes patience and planning, but can lead to increased safety and equine welfare, as well as happier human clients. It can be accomplished by creating a relaxing environment in which

to conduct exams and procedures, recognizing and reducing fear, applying techniques such as counterconditioning and positive reinforcement to increase desired behavior and stop problem behaviors, and using low-stress restraint properly. These and other methods described in this paper are summarized in Table 2. When positive techniques are continued between veterinary visits and over the horse's lifetime, the risk of relapse of the fear, anxiety, and behavior problems are minimized.

Acknowledgments

Dr. Foster has worked as a professor of animal learning and behavior since 1992 and conducts university-based research on equine behavior and horse-human interactions. She also consults privately on equine behavior problems and training cases as a Certified Applied Animal Behaviorist and International Association of Animal Behavior Consultants (IAABC) Certified Horse Behavior Consultant.

Declaration of Ethics

The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA.

Conflict of Interest

The Author has no conflicts of interest.

References

1. Survey reveals high risk of injury to equine vets. *Vet Rec* 2014;175:263.
2. Pearson, G. Advancing equine veterinary practice by application of learning theory: Injuries to vets, owners and horses can be reduced by taking a scientific approach to horse handling during veterinary exams. *International Society for Equitation Science*, Press Release 2012.
3. AVSAB Position Statement: Positive Veterinary Care. *Am Vet Soc Anim Behav* 2016. Available from: www.AVSAB.org.

4. Herron ME, Shreyer T. The pet-friendly veterinary practice: A guide for practitioners. *Vet Clin North Am Small Anim Pract* 2014;44(3):451–481.
5. McGreevy, P. *Equine behavior: A guide for veterinarians and equine scientists*. 2nd ed. Edinburgh, Scotland: Saunders-Elsevier, 2012.
6. Yin SM. *Low stress handling, restraint and behavior modification of dogs and cats: Techniques for developing patients who love their visits*. Davis, CA: Cattle Dog Publishing, 2009.
7. Kleiman DG, Thompson KV, Baer CK. *Wild mammals in captivity: Principles of and techniques for zoo management*. 2nd ed. Chicago, IL: Chicago University Press, 2013.
8. Maple TL, Perdue BM. *Zoo animal welfare*. Berlin, Germany: Springer, 2013.
9. Pearson G. Practical application of learning theory, part 1. *In Pract* 2015;37:251–254.
10. AVSAB Position Statement: The Use of Punishment for Behavior Modification in Animals. *Am Vet Soc Anim Behav* 2007. Available from: www.AVSABonline.org.
11. Lethbridge E. *Knowing your horse. A guide to equine learning, training, and behavior*. Hoboken, NJ: Wiley-Blackwell, 2009.
12. Mullard J, Berger JM, Ellis AD, et al. Development of an ethogram to describe facial expressions in ridden horses. *J Vet Behav* 2017;18(2):7–12.
13. Glatthaar A. *Pferde unter sich Verhalten und Verständigung*. Schondorf, Germany: Wu Wei Verlag, 2012.
14. McDonnell S. *A practical field guide to horse behavior: The equid ethogram*. Lexington, KY: The Blood Horse, Inc, 2003.
15. Thomas BL, Cutler M, Novak C. A modified counterconditioning procedures prevents the renewal of conditioned fear in rats. *Learning Motivation* 2012;43:24–34.
16. Kurland, A. *The click that teaches: A step-by-step guide in pictures*. Delmar, NY: The Clicker Center, LLC, 2003.
17. Watson J, McDonnell S. Evaluation of the effectiveness of three non-confrontational handling techniques on the behaviour of horses during a simulated mildly aversive veterinary procedure. *Proceedings of the 12th International Equitation Science Conference*, Saumur, France, June 23–25, 2016.
18. Pearson G. Practical application of learning theory, part 2. *In Pract* 2015;37:286–292.
19. Flakoll B, Ahmed AB, Saab CY. Twitching in veterinary procedures: How does this technique subdue horses? *J Vet Med* 2017;18:23–28.