

The Humane Society Institute for Science and Policy
Animal Studies Repository

1981

Equine Behavior Problems in Relation to Humane Management

Katherine A. Houpt
Cornell University

Follow this and additional works at: http://animalstudiesrepository.org/acwp_ewp

 Part of the [Animal Studies Commons](#), [Behavior and Ethology Commons](#), and the [Comparative Psychology Commons](#)

Recommended Citation

Houpt, K.A. (1981). Equine behavior problems in relation to humane management. *International Journal for the Study of Animal Problems*, 2(6), 329-337.

This Article is brought to you for free and open access by the Humane Society Institute for Science and Policy. It has been accepted for inclusion by an authorized administrator of the Animal Studies Repository. For more information, please contact eyahner@humanesociety.org.

Equine Behavior Problems in Relation to Humane Management

Katherine A. Houpt

The behavior problems of horses are frequently related to management practices. Behaviors that are termed stall vices appear to be either stereotyped behaviors that occur in reaction to stress, or patterns that emerge when natural behaviors such as grazing are prevented. The behavior cases presented to the New York State College of Veterinary Medicine, Cornell University, were tabulated: 27% were stall vices and 27% were some form of aggression. The stall vices were circling, digging, kicking the stall, chewing wood, swallowing air or self-mutilation. Management of horses on pasture rather than in stalls prevents the development of many of these stall vices and should, therefore, be considered a more humane treatment particularly for those horses that do not adapt well to confinement.

Aggression toward other horses is a problem that results from isolating horses, which prevents formation of the normal equine social hierarchy. The social structure of free-ranging and domestic horse herds is reviewed in order to compare it with the structure created by modern management practices.

Behavior patterns under natural and various management regimes are also compared.

Introduction

There was a time when cruelty to horses was widespread. When everyone depended on horses for transportation and as a source of energy for pulling, lifting and generating power, many horses were beaten, underfed and allowed to die from neglect or infectious disease. The excesses portrayed in novels such as Anna Sewell's *Black Beauty* (1949) were not imaginary. One would assume now that horses are used for pleasure (either entertainment or recreation), there would be little inhumane treatment of the species. By and large that is true. The more obvious forms of abuse such as "soring," i.e., creating wounds on a Tennessee Walking horse's legs so it will lift its hooves higher, have been declared illegal (Horse Protection Act Amendments of 1976). Nevertheless, there are still situations in which horses are mistreated. The forms of mistreatment are much more subtle. In addition, the mistreatment is often a result of environmental factors rather than a direct result of the owner's action. There are two general areas in which care must be taken to consider the well-being of the horse: stable management and social environment.

Modern equine management is a science rather than an art in many respects. Knowledge of equine nutrition has increased to the point where mineral balance as well as protein and energy content are considered in formulating a ration. The advances in reproductive science have also been extensive. The result is that horses, once seasonal breeders, can now conceive at any time of year (Ginther, 1979). The problems that arise, however, are a result of some technological advances and of urbanization. In considering stress on livestock, Ewbank (1973) has given three criteria for determining if a given situation is stressful: 1) changes in behavior that result in a

Dr. Houpt is Assistant Professor in the Department of Physiology, New York State College of Veterinary Medicine, Cornell University, Ithaca, New York 14853.

decrease in productivity; 2) changes in behavior that do not affect productivity; 3) changes in patterns of behavior without changes in type of behavior. When one applies these criteria to the horse, one can find examples of all of these responses to stress. Some horses do refuse to jump, to run, or to reproduce. Much more common are problematic changes in the horse's behavior. Not all behavior problems in horses are a result of inhumane treatment or even of mismanagement, but one type of problem is often the result of management practices. This type is the so-called stall or stable vice. The horse misbehaves, not when it is being ridden, but rather while in its stall. The important phrase is "in the stall" because some horses do not adapt as well as others to stall confinement.

The New York State College of Veterinary Medicine offers counsel on and treatment of behavior problems as well as medical services to large and small animals. The cases of abnormal or objectional behavior of horses presented reflect the responses to stress produced by management. See Table 1 for the types of cases seen. Examples will be presented of typical clinical cases that are either losses of productivity, changes in behavior, or changes in behavior patterns without changes in type of behavior.

TABLE 1. Categories of Equine Behavior Problems Seen at the New York State College of Veterinary Medicine — 1980

Stable vices (pawing, circling, weaving, kicking stall, windsucking)	27%
Aggression	27%
Misbehavior under saddle	16%
Trailer problems	8%
Self-mutilation	8%
Refusal to run	5%
Phobias — clipper shy	5%
Refusal to race	5%
Failure to breed	5%
Cross cantering	5%
Head tossing	5%

Total = 38 cases

Stall Vices—Oral

Wood chewing

The abnormal behaviors associated with stall confinement can take several forms. Either ingestive behavior or locomotion is affected. Of the so-called oral vices of horses, wood chewing is probably the most common. This is an example of a change in behavior pattern. Wood chewing is not restricted to stalled horses; it can also be observed in horses kept in paddocks. This is a clue that confinement alone is not the cause, although confinement usually aggravates the condition. Lack of roughage in the diet predisposes a horse to wood chewing. Horses fed hay chew less wood than horses fed a high energy, low roughage diet. There may be an innate preference or even a craving for roughage in horses. These true herbivores spend 60-90 percent of their time grazing when on pasture or range (Duncan, 1980; Tyler, 1972; Wells and Goldschmidt-Rothschild, 1979) and consume browse or woody plants as well as grass. The horse kept in a stall 23 hours a day may chew up to a

pound of wood from the edge of the stall rather than the more succulent twigs it would prefer. Willard *et al.* (1977) found that ponies kept in stalls and fed a high concentrate diet spent 10% of their time eating wood. This dropped to 2% when a high roughage diet was substituted. There have been no quantitative studies of wood chewing in horses in paddocks or corrals, but when neither hay nor pasture is available the horse may chew the fence. We have noted that wood chewing is inhibited by inclusion of sawdust in a high concentrate diet. Although this is one "treatment," access to pasture with nonpoisonous woody plants available and/or feeding of hay would be the best management procedure.

It is easy to recommend pasture, but difficult for many horse owners to find pasture. With increasing urbanization and increasing ownership of horses it is inevitable that many horses will be kept in suburban or even urban areas. There is no pasture and little room to keep hay, were it easily available. Complete pelleted feeds made of grain and chopped hay is a common diet of the modern horse. Such a diet is nutritionally adequate, but the horse may respond by literally eating down the barn around it. The prospective horse owner should therefore consider the circumstances under which the horse will live before acquiring the animal.

Cribbing and wind sucking

A second oral vice of horses is termed "cribbing," or crib biting. When cribbing, a horse grasps the edge of its manger or wall with its teeth, arches its neck, and swallows air. A few horses do not need to grasp an object with their teeth, but still swallow air ("wind sucking"). There is some question as to whether cribbing results in poor digestion or poor digestion results in cribbing. It is often more annoying to the owner than dangerous to the horse. Nevertheless, surgical treatments such as removal of six inches of each of three pairs of ventral neck muscles, the omohyoideus, sternocephalicus and sternothyroideus, have been recommended (Frank, 1959). More recently, bilateral ventral accessory neurectomy has been advocated, but after a few months the cribbing horse may begin again (Firth, 1980). Mechanical devices to inhibit arching of the neck, usually straps around the upper neck, are the most common treatment of cribbing. This treatment usually prevents the behavior, but does not remove the cause of the behavior as a proper treatment should. Once cribbing becomes a habit the horse may continue it, even on pasture. There is a widely held belief among horsepeople that cribbing is "contagious," that is, if one horse cribs all or at least some of the other horses will follow suit. This may be social facilitation of the behavior, or an indication that the environment is predisposing to the development of stable vices.

Stall Vices—Locomotor

Kicking, weaving and pacing

Certain other types of stable vices are forms of locomotion, perhaps even of escape behavior. These vices are pawing, kicking the wall, circling and weaving and digging in the stall. Stall kicking is the most obvious because the reverberations are heard for long distances. The cause of this type of behavior, like that of so many stable vices, is unknown, but it may be a lack of stimulation.

A 9 year old Thoroughbred gelding was presented with a history of "stall walking." The horse circled when confined and had been doing so for 5 years. This case may fall into the category of a decrease in productivity, as the horse had been retired from the race track because of its behavior. It expended too much of its

energy circling in the stall to race well. Well-meaning but ill-informed horse owners may attempt to deal with stable vices by preventing the animal from engaging in the objectionable motor activity without attempting to eliminate the cause of the misbehavior. In this case the horse had been tied so that it could not circle or pace. The horse responded by weaving, that is, by shifting its weight from side to side without progressing forward. The owners realized immediately that tying was not a cure. They then gave the horse the freedom of a large aisle in the barn. The horse continued to circle at one end of the aisle. The owners had noted that exercise tended to decrease the circling and that preparations for a horse show or hunt increased the incidence of the behavior. They were advised to keep the horse on pasture with other horses, and allow the horse free access to the barn in winter. The owners lived on a farm so that this was easily accomplished. The horse did not circle on pasture. Confinement, even in a large enclosure, was apparently the cause of the behavior.

One pony stallion that was used to "tease" Thoroughbred mares, that is, allowed to approach and sniff, but not to copulate, began to weave in his stall. How often stall vices are such a direct result of frustration of sexual or other behaviors is unclear, but many horses that circle or weave in confinement do not do so on pasture in the company of other horses.

Another case involved two horses in the same environment, each of which exhibited stable vices. The 5 year old mare paced in her stall. The 2 year old gelding kicked at the walls of the stall and bit itself. A detailed history is always obtained from the owners of horses with behavior problems. The history of these two animals was particularly enlightening, revealing that the gelding was the son of the mare. The owner had inadvertently perpetuated a family of horses that do not respond well to confinement. The gelding not only showed abnormal behavior, but also a loss of productivity or usefulness because while kicking it had injured its hind legs severely enough to require veterinary care.

Horses moved from dirt-floored, well-bedded stalls to ones with wooden floors may cease to kick the stall, as if the noise of their hooves striking the floor were sufficient stimulation. Other suggested treatments have been to pad the stall or to hang a large ball on the horse's tail so that it hits the horse whenever it kicks. The padded stall should be used if the horse has a hind leg injury that is aggravated by the jolt of contact with the wall, but in other circumstances the owner may only be removing the reward value of the behavior without removing the cause.

Pawing

Pawing is a normal behavior of horses. They paw to reach grass buried under snow, but they also paw in many other circumstances. A mare may paw her foal to rouse it. If the foal is unable to rise, the pawing may actually injure the animal. Horses paw when they are attempting to run or attempting to reach food, but are prevented from doing so (Ödberg, 1973). Some horses paw while eating freely available grain. The reason for this response is unknown. Pawing in the above circumstances would not be considered a vice, but some horses paw so frequently that they dig holes in the stall. Horses usually cannot paw through concrete floors, but this approach, like the cribbing strap, is not removing the cause of the behavior. The cause is unknown, but since it occurs most frequently in stabled horses and least frequently in horses pastured in groups, the confinement and social isolation of the stall environment are implicated.

An extreme example of digging was presented by a 2 year old Standardbred horse. It had been housed in a runout shed. When transferred to a stall it began to

paw, and dug holes 3 feet deep. When plywood was placed in the stall 10 inches below sawdust, the horse dug down to it. Punishment has not alleviated the condition. A stall companion, return to a runout environment and training the horse not to paw by rewarding it with food were suggested in order of probability of reducing the incidence.

Other Stall Vices

One of the stall vices that can be dangerous to the horse itself is flank biting. Horses with this habit bite at their sides usually only damaging the hair, but occasionally mutilating themselves. This behavior is not the quiet gnawing similar to that of a dog chewing its paws, but is an intense behavior in which anyone in the way may be injured. In most cases stall kicking and vocalization accompany the biting.

Three separate cases were presented of horses that bit themselves. All were males, and the problem does appear to be more common in stallions than in castrated males. All occurred at the height of the equine breeding season. None of these animals had any medical problem, such as pruritic dermatitis, gastrointestinal pain or heavy intestinal parasitism, that would be responsible for such behavior. One case was interesting in that the biting began when the stallion's dam was brought to the stallion's stable after a 4 year separation. The animals had not been together since the stallion was weaned. The most severe case was a Thoroughbred stallion that began to bite itself as soon as it was retired from racing. Tranquilizers had little or no effect. When a cradle was placed on the horse so that it could not reach its flanks it continued to rear and twist attempting to bite itself. Despite the violence of the horse's behavior, the problem was easily resolved. The stallion was placed on pasture with a barren mare. The biting ceased and the barren mare was soon pregnant. (Dr. Julie Wilson of the College of Veterinary Medicine, University of Florida, Gainesville provided this case.) When pasture is not available, provision of a stall companion such as a donkey sometimes helps to ameliorate the problem.

A final case of failure to adapt to stall confinement was a 4½ year old Quarter-horse that had been raised in a field until the age of 3½. When confined in a stall the horse tried to escape by climbing out, tunneling out under the sides, or by leaning on the door. When not engaged in more active attempts to escape she circled, pawed or weaved. This behavior persisted for one year. She also tried and often succeeded in escaping from a paddock, but presented no problem when kept in a field with other mares. The early history of this horse may account for her adult behavior problems. Perhaps if she had been accustomed to confinement alone or even with her dam she might not have reacted so badly to stalls and paddocks as an adult. Because most horses must be stalled, it would be wise to provide some experience of stalls to foals and ease their adjustment to common management situations.

A problem we have not yet encountered in a clinical patient, but have seen in experimental ponies, is polydipsia nervosa, or psychogenic polydipsia. It occurs most often in isolated, confined horses that have free access to water. Usually the only disadvantage is the amount of urine produced when a horse drinks 100 or more liters per day, but gastrointestinal pathology may result (Fraser, 1980).

Learned Behavior

Stall vices are not always responses to stress. At times the particular behavior may have been rewarded and the horse continues to perform the behavior. A horse

may paw just before feeding one day. It receives its grain as it is pawing. The next day it paws and food appears. Soon the horse is operantly conditioned to paw to obtain food. Horses paw, shake their heads and even kick the stall for this reason as well as because they are stressed. Therefore care must be taken to determine whether there is a pattern to the behavior, that is, is it occurring more often just before feeding? In these cases the owner can teach the horse not to paw by feeding it only when it is not pawing.

An example of this type of learned behavior can be seen in a 7 year old Quarterhorse that bit his feed bucket or attacked the stall door just before feeding. Such behavior is a good example of "superstitious" actions. The horse performed the actions because food had rewarded the behavior. It is relatively easy to eliminate superstitious behavior by removing the reward. It will take a long time for the behavior to extinguish; the longer it has been rewarded the longer it will take for the animal to extinguish the response. The owner should not feed the horse if it is biting the bucket or striking at the stall door. At first the horse should be rewarded for any pause in the unwanted behavior. Later 20 seconds of good behavior will be required for a food reward. Still later half a minute will be required.

Aggression

The other common equine behavior problem is aggression. Aggression is not usually expected to be a common trait of a domesticated ungulate. Nevertheless an examination of the normal herd structure of the free-ranging horse and a comparison with the structure imposed under conditions of modern husbandry may help to explain the high incidence of aggression. Horses live in harem groups composed of several adult females, their offspring and one, or less commonly, several, adult males (Feist and McCullough, 1976; Berger, 1977; Gates, 1979; Tyler, 1972; Miller and Denniston, 1979). The offspring are newborn foals, yearlings, and 2 or 3 year old animals. The fillies may remain with their original herd or join another herd at 2 or 3 years of age. The colts are believed to be driven off by the harem stallion when they are 2 years old. The colts do not join another herd, but form a bachelor herd or live as solitary individuals. The harem groups are stable. An older mare is the dominant animal and leads the group. The stallion wards off other males, especially young stallions from bachelor groups that attempt to appropriate mares of their own. There are dominance hierarchies within both the harem groups and the bachelor herds. Horses under 3 are usually submissive to adult horses. The dominant animal has first access to food, salt or a desirable resting area. Stallions need not be dominant over all the mares of the harem group (Houpt and Keiper, 1982), but within a bachelor herd it is the dominant stallion that is most likely to acquire mares of his own.

The same or very similar dominance hierarchies exist among groups of domestic horses that are allowed to interact (Montgomery, 1957; Houpt *et al.*, 1978; Serini and Bouissou, 1978). Overt aggression is usually minimal among groups of horses. Threats replace bites and kicks once a hierarchy is formed. Problems arise when horses are isolated from one another and have not had the opportunity to form a hierarchy. Addition of new horses to a group also results in high levels of aggression. When two horses meet in a ring or trail they may fight rather than merely threaten because they have not had the opportunity to determine which animal is dominant. If this aggressive behavior occurs in a crowded show ring, riders as well as horses may be injured. It is interesting to note that horses are most likely to aggress against one

another when one passes another at a fast gait. Why a galloping horse is more likely to kick than a walking one is unclear. Although a good, firm rider can discipline the horse and train it to suppress its aggressive tendencies, less experienced or weaker riders will continue to have difficulty. Forced association with strange horses is the root of the problem. Horses should probably be given the opportunity to interact, first across a paddock fence and then in the same paddock to determine their relative social positions.

The large number of aggressive horses includes some that are aggressive toward humans. These animals are generally aggressive in their stalls. They turn their hindquarters toward an approaching person and threaten to kick. One can attempt to treat this behavior by punishing the horse, but many horse owners are unwilling or unable to exert the force necessary to punish the animal. A light blow often serves to irritate the animal further. In addition the punishment must be administered just as the animal misbehaves. If one waits until one has gotten a whip it will be too late. It has proved easier to reward good behavior by giving food only when the horse approaches in a friendly fashion. Many different people should approach the horse and reward it for unaggressive behavior; if only one person does so the horse will not generalize to all people. Aggression may also occur between stabled horses. Horses may bite or kick the horse in the next stall. Two questions must be answered. Are the horses actually aggressing against one another or are they playing, whiling away the many hours they must spend with nothing to do? The second question is whether the horse attacks any horse in the next stall or just one particular horse. When horses choose their own stalls aggression may be reduced because "preferred associates" will be neighbors (Clutton-Brock *et al.*, 1976). This is true only if food is easily and always available. For example, in order to photograph aggression between two horses in a barn it is only necessary to roll the feed cart down the aisle. If twenty horses are trying to feed from a hay rack built for ten, constant squabbles erupt. Crowded horses and hungry horses are most apt to be aggressive.

Discussion

None of the horses mentioned here had been cruelly treated. In fact, most have been owned by people devoted to the species and its improvement. Nevertheless, the environmental conditions of race horses, show horses and suburban pleasure horses are not the natural ones of the horse. The majority of horses adapt to the unnatural conditions, but a few do not. These horses probably should be removed from the environment. Since it is unlikely that the process of urbanization will be reversed, horses with these problems should not be bred. This advice pertains no matter how fast they are and no matter how well they jump, cut cattle or perform dressage. The 21st century horse, like the 21st century dog, should be one that can live quietly in confinement without further restraints such as cribbing straps or cradles to prevent abnormal behavior.

A more positive approach to the problem may be to redesign stables with the horse's behavior in mind. One apparently successful design is to stall horses so that they face one another. Most straight stalls are designed for the human with the horse's tail facing a center aisle so that the manure can easily be removed. If the horses face one another there will be more work for the stable hands. It has been noted that horses that circle in box stalls stand quietly in straight stalls, if they can

always see horses in front and to the side (Michael Osborne, per. comm.). The improvement in performance of working horses and in conception rate of previously infertile mares should offset the additional labor and wider stable needed when manure is collected on the outside rather than the middle of the stable. The best environment for horses still remains a pasture with sturdy fences, plenty of grass, a little browse, a few other horses, and a three-sided shelter.

Conclusions

Horses have changed little behaviorally since they were domesticated. Although modern horses are removed from the dangers of starvation and predators, they may fall victim to the stress of confinement. The stress is reflected in a variety of behaviors known as stall or stable vices. The loss of grazing time leads to wood chewing and possibly to cribbing. The confinement itself and the solitary nature of the confinement leads to circling, weaving, pawing, self-biting, and kicking the stall. Artificially formed groups can lead to aggression and injury of horses.

Every effort should be made to create as naturalistic an environment as possible for horses, but also to eliminate those horses from the breeding population that do not adapt to modern stable conditions.

References

- Berger, J. (1977) Organizational systems and dominance in feral horses in the Grand Canyon, *Behav Ecol Sociobiol* 2:131-146.
- Clutton-Brock, T.H., Greenwood, P.J. and Powell, R.P. (1976) Ranks and relationships in highland ponies and highland cows, *Z Tierpsychol* 41:207-216.
- Duncan, P. (1980) Time-budgets of Camargue horses, II. Time-budgets of adult horses and weaned sub-adults, *Behaviour* 72:26-49.
- Ewbank, R. (1973) The trouble with being a farm animal, *New Scientist* 60:172-173.
- Feist, J.D. and McCullough, D.R. (1976) Behavior patterns and communication in feral horses, *Z Tierpsychol* 41:337-371.
- Firth, E.C. (1980) Bilateral ventral accessory neurectomy in windsucking horses, *Vet Rec* 106:30-32.
- Frank, E.R. (1959) *Veterinary Surgery*, 6th ed. Burgess Publishing Co., Minneapolis, MN.
- Fraser, A.F. (1980) *Farm Animal Behaviour*, 2nd ed. Bailliere-Tindall, London, UK, p. 248.
- Gates, S. (1979) A study of the home ranges of free-ranging Exmoor ponies, *Mammal Rev* 9:1-18.
- Ginther, O.J. (1979) *Reproductive Biology of the Mare: Basic and Applied Aspects*. McNaughton and Gun Inc., Ann Arbor, MI.
- Houpt, K.A. and Keiper, R.R. (1982) The position of the stallion in the equine dominance hierarchy, *J Anim Sci*. Submitted for publication.
- Houpt, K.A., Law, K. and Martinisi, V. (1978) Dominance hierarchies in domestic horses, *Appl Anim Ethol* 4:273-283.
- Miller, R. and Denniston, R.H., (1979) Interband dominance in feral horses, *Z Tierpsychol* 51:41-47.
- Montgomery, G.C. (1957) Some aspects of the sociality of the domestic horse, *Trans Kansas Acad Sci* 60:419-424.
- Ödberg, F.O. (1973) An interpretation of pawing by the horse (*Equus caballus* Linnaeus), displacement activity and original functions, *Saeugetierkundliche Mitteilungen* 21:1-12.

- Serini, J.L. and Bouissou, M.F. (1978) Use of a food-competitive method as an indicator for dominance relationships in horses, *Biol Behav* 3:87-93.
- Sewell, A. (1949) *Black Beauty*. Random House, New York, NY.
- Tyler, S.J. (1972) The behaviour and social organization of the New Forest ponies, *Anim Behav Monogr* 5:87-196.
- Wells, S.M. and Goldschmidt-Rothschild, B. (1979) Social behavior and relationships in a herd of Camargue horses, *Z Tierpsychol* 49:363-380.
- Willard, J.G., Willard, J.C., Wolfram, S.A. and Baker, J.P. (1977) Effect of diet on cecal pH and feeding behavior of horses, *J Anim Sci* 45:87-93.

Animal Welfare Science Essay Competition

Deadline: December 31, 1981

Two \$500 Prizes

Competition Rules:

- All enrolled veterinary students and graduate students in Animal Science in the U.S. (including those who have graduated within six months of the deadline) are eligible to compete.
- The two best essays, selected by a panel of judges comprised of veterinarians, philosophers, ethologists and other relevant scientists, will be awarded a cash prize of \$500 and a Certificate of Appreciation. Judging criteria will include quality of writing, the accuracy of the supporting data and the extent to which opposing viewpoints have been taken into consideration and/or refuted.
- Essays should be between 4,000-5,000 words in length and may be based on literature and analyses, data gathering projects or personal viewpoints. All essays should be thoroughly documented with appropriate citations and references using the JAVMA format.
- The winners will be welcome to submit their essays to the International Journal for the Study of Animal Problems for consideration of publication.
- Copyright of the winning entries will be transferred to the Institute for the Study of Animal Problems as a condition of receiving the award. The author's rights will be reserved.
- Candidates who are in doubt about the suitability of proposed topics are invited to contact Dr. Michael W. Fox for advice. Examples of subjects from which essay topics (either broader or more specific) may be selected include:

Trapping
 Predator Control
 Farm Animal Husbandry and Welfare
 Use of Animals in Teaching
 Humaneness and Veterinary Ethics
 Ethical and Legal Aspects
 of Animal "Rights"

Euthanasia Techniques
 Laboratory Animal Welfare
 Zoo Animal Behavior Problems
 Welfare of Circus Animals
 Rodeo Animals/Race Horses
 "Pet" Welfare and Owner/Breeder
 Responsibilities

Sponsored by: The Institute for the Study of Animal Problems
 2100 L Street, N.W., Washington, D.C. 20037

Send Essays or Enquiries to the Attention of: Dr. Michael W. Fox