Vet Clin Small Anim
33 (2003) 417–446

THE
VETERINARY
CLINICS
Small Animal Practice

Behavioral considerations in the management of working dogs

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Arguably, ''a dog is a dog''; therefore, it should be true that ''canine behavior is canine behavior.'' It is readily apparent even from casual observation of canine behavior that a great degree of variation exists in what are considered normal and abnormal behaviors as compared between different breeds and even between individual animals of the same breed [1]. The employment of dogs in working or performance settings entails a different kind of management style and a different intensity of effort than that required for a house pet, show dog, or laboratory animal. These differences exist not only in the change in focus from individual patient to ''herd health'' but in almost every aspect of behavioral management of the individual.

A focus on working or performance can alter the basic behavioral criteria by which animals are selected for training or breeding, the ways in which they are bred and raised, training techniques employed to produce desired behaviors and eliminate undesired behaviors, the perspective used to evaluate and deal with performance failure and behavioral problems, and even the determination of behavioral criteria for continuing employment of an animal.

Nonetheless, some behaviors that are problematic to pet owners are also problematic in many working dogs. A candidate retriever that is overly active, distractible, and inattentive has a behavioral problem as worthy of attention as a pet dog that cannot learn its obedience commands or successfully walk on a leash. Even an attack-trained military working dog

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PII: S0195-5616(02)00133-X

that bites its handler or another unintended victim is considered to have a behavioral problem involving an unacceptable display of aggression toward human beings, as would a house pet that nips at the ankles of strangers that enter its house. A skilled helper dog that consistently cowers under furniture during thunderstorms is at least as much of a problem as a pet that does the same thing.

To be able to discuss the behavioral aspects of working dog management in sufficient depth but without creating an unmanageable volume, we need to limit our focus to a specific set of dogs and to choose areas of discussion that are likely to produce the best information for the reader. Working dogs can be broadly broken down into several subgroups, based, for instance, on the American Kennel Club (AKC) groupings [2]. The current AKC breed groups are sporting, herding, nonsporting, working, terrier, toy, and hound.

The traditional canine jobs reflected by these AKC groupings can be further divided into more specific tasks that these groups represent. The sporting group represents a collection of breeds that traditionally participate in hunting and includes dogs that are used to find, flush, chase, and retrieve game. The herding group includes breeds most commonly used to "control the movement of other animals." The working group includes those breeds that are traditionally used for guarding, pulling, and other physically demanding tasks. The hound group includes dogs that are traditionally employed to track or trail animals or people based on scent cues or to run fast or for long distances, and the terrier group includes breeds that have been traditionally employed to hunt small prey and pests.

Some employment opportunities for dogs do not conform to traditional breed or group definitions. For instance, retriever and other breeds are routinely used to locate and assist in the retrieval of lost persons and bodies, consistent with the "retriever" name. Their skills have also been found to be useful to assist persons with motor, visual, auditory, and other physical disabilities, however, and these dogs have become quite popular for tasks involving specialized substance detection tasks, especially in situations where public contact requires identification and acceptance of a working dog and an animal with a good temperament and tractability.

Even nonsporting and toy breeds have found employment opportunities. Their unique characteristics have proven quite useful in tasks that require access to small areas or, as in the case of the Dalmatian, as the traditional dog for mingling with, keeping up with, and protecting horses and wagons in transit.

The largest employers of working dogs are government and helper dog programs. The US Department of Defense employs approximately 1500 dogs that are used to protect military personnel and equipment from physical attack and to detect threats to safety and security, such as hidden explosives and illegal drugs, tasks for which these dogs have displayed excellent aptitude and efficacy (for historical examples of military working dog employment and types of tasking, the reader is referred to the article by

Lemish [3]). Most US military dogs are dually trained, meaning that they are capable of protection tasks through controlled aggression toward human beings and proficient in either explosive or drug detection tasks. Some German and other non-US police departments (eg, the Nordrhein-Westfalen State program) can employ in excess of 500 dogs [4]. Because of a greater degree of local organization (municipality versus state), US law enforcement programs are much smaller, but several large programs do exist outside of the military, such as the Connecticut State Police program [5]. Other US federal programs include the Transportation Security Administration (TSA) Explosives Detection Canines, Customs Service Drug Detector Dogs, Border Patrol Canine Program, and Department of Agriculture contraband-detecting "Beagle Brigade" [6].

Many helper dog programs exist in the United States and elsewhere in the world. Large-scale US programs include Seeing Eye, Guide Dog, and Canine Companions for Independence. These programs focus primarily on the use of dogs to allow individuals to live more independently by training and using dogs to perform tasks that the individuals cannot, such as reaching and grasping and even mobility assistance for individuals who have limited mobility, providing visual feedback and guiding movement for blind persons, and alerting and orienting to auditory cues for individuals who have impaired hearing. Dogs are also used as a treatment modality in hospitals and other settings [7,8]. Helper dogs often produce benefits to people that are not produced by specific training, such as increasing opportunities for social interaction in persons confined to wheelchairs [9] and providing positive emotional support and companionship in hearing-impaired owners [10].

The organization and philosophy of working dog programs vary tremendously. Some programs, such as the US Federal Emergency Management Agency (FEMA) Search and Rescue Dog effort, consist of a relatively loose-knit network of volunteer people and dogs that may (or may not) be available for emergency response. These volunteers usually acquire, train, and maintain their own animals [11]. Other programs, including many municipal police programs, are organized locally for local requirements and are loosely affiliated with other programs though professional associations (eg, National Narcotic Detector Dog Association, United States Police Canine Association). In these programs, the municipality usually acquires trained or untrained adult dogs on an "as needed" basis to match with a specific canine handler. Still other programs, such as the Department of Defense, are designed to acquire and train large numbers of suitable adult dogs procured from nongovernment sources while possessing all the resources and personnel required for training, certification, medical care, and other functions to sustain the program. Finally, some programs, such as the Australian Customs Service [12] and Seeing Eye [13], operate using selective breeding models that allow them to produce a reliable supply of candidate dogs to match their needs.

This thumbnail sketch of the varieties of governmental and public working dog programs is far from complete. Program development activities and resulting changes in strategy are the hallmarks of vibrant programs. Currently, the US Department of Defense, Transportation Security Administration, and Customs Service are all in the process of implementing and evaluating selective breeding models to produce candidate dogs for their programs [14]. Likewise, diverse programs from around the world are collaborating on an increasingly frequent basis on matters of veterinary care (eg, diagnosis and control of hip dysplasia [15,16]) and program management [17,18] and in the application of scientific research to program execution (eg, use of estrus-inducing drugs [19] or evaluation of temperament testing in candidate dog selection [20]). An example of a forum for such innovation and collaboration is the International Working Dog Breeding Conference, which was held in San Antonio in 1999 and 2001.

For the purposes of the rest of this article, ''working dogs'' refers most specifically to those dogs employed in large-scale governmental and public programs, where the dogs work in tasks related to protection and controlled aggression, substance detection, or provision of assistance to persons with disabilities (especially the US Department of Defense Military Working Dog Program). Dogs employed for sporting, running or pulling, and herding tasks and programs for the breeding and development of these dogs are less intensively addressed.

Behavioral assessment in working dogs

Behavioral assessment in working dogs is a key component in their employment. Assessment tools of one sort or another have been and are still being developed and applied to almost every aspect of a working dog's behavior. Testing in the working dog world is clearly quite different from the level of behavioral testing used in pet practice. For instance, instruments have been developed to determine the suitability of an animal for training [12,20] and to determine the level of proficiency in performing critical tasks (eg, United States Police Canine Association Certification Tests). Tests have also been developed to predict how well an animal comports itself around other animals and around human beings (eg, Delta Society Pet Partners Team Evaluation [21]). Other instruments are beginning to be used to evaluate the presence of potentially heritable behavioral pathologic characteristics (eg, the use of the lactate response test to identify excessive fearfulness) [22] or to determine possible limitations of a dog's learned behavior or performance [23].

Assessment of working dog behavior usually begins when a juvenile or adult candidate is considered for training or when puppies that are purposefully bred for a particular use are evaluated for the presence of the required behavioral characteristics. These behavioral assessments attempt to

evaluate stabile behavioral characteristics that might be referred to as "temperament" and "aptitude."

Measures of temperament attempt to predict the likelihood of specific social interactions between a dog and people or other animals. In pet practice, the objective is usually to select animals that display inquisitive and solicitous interaction with people and to select against animals that are likely to display flight, ambivalence, apprehension, asociability, or aggression toward others [1]. In working dogs, the social interactions desired require more definition and exhibit some difference from those desired for pet dogs. For instance, words used to define social interactions in guide dogs could include calm, observant, and tolerant. Conversely, in military or police dogs, the definition might include inquisitive, confident, and dominant.

A problem immediately arises in making such temperament assessments. The terms we often use are qualitative. Also, these terms often possess a high degree of connotation and anthropomorphism. In other words, a term often alludes to an unmeasurable, "internal state" of the animal, and such terms are often bound heavily to our understanding of normal (and abnormal) human behavior and are also based on personal experience.

An example of such a difficulty in the use of behavioral constructs is the use of a term such as *fearful*. Most people would agree that it is not desirable for a pet or working dog to demonstrate a large degree of fearfulness. My understanding of "fearful" clearly differs from that of my 6-year old son or my bungee-jumping colleague at work (an illustration of a situation that might have wide interrater reliability problems). In addition, we have no assurance that any human perception of "fear" (or a situation that might reliably cause fear in a person) is reflective of a similar state in a dog experiencing the same stimulus milieu (representing a potential problem in the validity of a measure).

A full discussion of temperament test development issues is beyond the scope of the present article, but an excellent review of the primary issues may be found in an article by Goodloe [24]. To summarize the challenges we face in attempting to measure internal states or social proclivities in dogs, the challenge is to produce a test that actually predicts how an animal would behave in a situation of importance to us and to develop measures that are repeatable from time to time for a single observer and also repeatable between different observers.

To get around these potential pitfalls in making predictions about future behavior, the radical behaviorist would reject the use of temperament and temperament-related terminology completely, relying only on the measurement of observable desirable and undesirable behaviors and of relations between stimulus events and these behaviors exclusively. Arguably, this approach provides the strongest predictive model of future behavior (indeed, volumes by Skinner and others have been dedicated to the prediction and control of behavior using only observable behaviors, stimuli,

and consequences [25]), but this approach also suffers from an inability to predict future behavior when only slight changes occur in the behavioral equation, as was illustrated with a bit of humor by the Brelands [26] (who were Skinner's students) in their work with applied operant conditioning of performing animals.

Fortunately, a workable middle ground exists to develop tests to measure temperament characteristics that could be important in predicting successful working dog training and behavior. One approach is to identify physiologic correlates or overt and easily measurable overt behavioral responses that accompany a less observable behavioral state, such as using the lactate test described by Overall et al [22] to identify fearful animals.

Another strategy is to measure a number of observable behaviors in various settings that may or may not be related to a presumed behavioral characteristic and then to let statistical tools determine relations between the measured behaviors themselves and their usefulness in predicting other behaviors in the future. This kind of work initially saw its heyday in the Jackson Laboratory at Bar Harbor, Maine, in the work of Scott and Fuller [27] and their colleagues. It is interesting to note that the authors relied heavily on the use of temperament terminology, but related the terminology directly to carefully controlled experiments, where they measured observable behavior, deriving mostly quantitative measures, such as response latency, social interaction counts, and the like. Another interesting observation is that this line of research recruited investigators such as Anastasi [28], Pfaffenberger [29], and Cattell [30], whose work would later play a central role in the development of human test theory and educational and clinical assessments.

Only recently has there been a sustained resurgence of interest in subjecting canine performance and temperament tests to factorial analysis and other statistical methods to ensure the reliability of these instruments and items in them and to determine whether the measures are valid predictors of future outcomes. A novel application of factorial design was recently reported by Serpell and Hsu [31]. These authors prepared a semantic differential behavior rating scale instrument in the form of a questionnaire that they administered to volunteer puppy raisers of prospective 1-year-old guide dogs, from which they extracted reliable measures, identified 8 common factors among their 40 items, and then successfully validated these factors against the school's criteria for accepting or rejecting candidates. These results are different from strict performance tests, because the authors relied on puppy-raiser opinions of their animal's behavior; they also differ from the work of Hart and Hart [1], because the Serpell and Hsu study [31] relied on owner observation of individual animals rather than on human assumptions about a breed-specific stereotype. In addition, Serpell and Hsu [31] validated their results against actual outcomes (accept or reject a candidate dog). In her book entitled *Canine Behavior*, Beaver [32] reviewed the work of Scott and Fuller and their

attempt to unravel the behavioral genetics of the dog in a section on the diagnosis of behavioral problems and lamented that, ''Expense alone probably means a similar effort will never occur again.'' If recent interest in selective breeding, quantitative genetics, and assessment continues, Beaver's prediction may be proven wrong.

Assessment of aptitude and performance in working dogs may prove to be more easily addressed than that of temperament, because these constructs are usually measured by evaluating the performance of a task in a defined setting, either with or without training. The three significant issues in measuring aptitude for future learning or performance are (1) the need to ensure that the behavior on the aptitude test actually has a significant predictive relation to performance on a meaningful task later, (2) the results of the task are not overly affected by learning, and (3) the tests performed and the measures obtained are repeatable both within and between animals and observers (either with or without modification of the test for age). These issues are addressed by Hilliard and Burghardt [14] in their article on the development of performance tests to be used at different ages in growing candidate working dogs. The authors used a combination of temperament assessments conducted by trained observers and structured performance tests, distilling the data using factor analysis and then validating the results against each candidate's success or failure in training. The authors concluded that the predictive value of tests rapidly increases until at least 6 months of age in Belgian Malinois Dogs, which is produced by selective breeding in their program. Beaudet et al [33] also address the value of behavioral tests and activity level measures performed in puppies and repeated at various ages in predicting dominance behavior later in life. They also conclude that the value of the tests increases with age. As tests are developed further, it would be ideal for a working dog breeding program to be able to discriminate between successful and unsuccessful candidates at younger ages rather than at the traditional 12 to 15 months of age, because raising a puppy becomes progressively more resource-intensive as the puppy grows and training time is particularly precious. It should be noted that puppies unsuitable for training usually find other forms of employment or are otherwise adopted as pets.

A final issue to address in this section on behavioral assessment in working dogs is the assessment of limits to performance. The discussion that follows showcases two unpublished projects performed at the Department of Defense Military Working Dog Veterinary Service by Hilliard and Burghardt.

The first of these studies asked a clinical question regarding older military working dogs. A number of authors have published reports describing the clinical presentation, performance deficits identified in laboratory settings, underlying pathologic findings identified in the brains of affected animals, and treatment of behavioral decrements in pet and laboratory dogs, defined now as canine cognitive dysfunction (CCD) [34]. The question arose as to

whether CCD could be demonstrated in military working dogs and whether the disease affected performance in critical tasks. The gold standard for measuring CCD in dogs behaviorally involved asking the dogs to solve a task in which they were asked to respond to the correct object in an object presentation task when the correct and incorrect objects were reversed and after varying periods of delay. The apparatus used to assess performance is called the Toronto General Testing Apparatus (TGTA). Performance on the TGTA tasks is measured in errors to criterion performance; lower numbers of errors indicate faster acquisition of a task. Fig. 1 represents data provided from Milgram's laboratory in Toronto in a group of normal subjects and data in a group of normal military working dogs at Lackland Air Force Base in Texas performed as a replication. Both sets of data are fairly similar, indicating that the military working dogs tested were not greatly dissimilar in their ability to perform this task compared with laboratory Beagles.

Fig. 2 represents data from two aged working dogs at Lackland (Tara, aged 10 years, and Toots, aged 12 years) compared with the TGTA normals. By definition, Tara is impaired on the task and would be diagnosed with CCD using this standard. It is interesting that Tara continued to work superbly in a special project as a substance detection dog well beyond the time this test was administered. Although the prospect of identifying and treating CCD in military working dogs seems appealing as a means of improving the quality of a patient's life and possibly extending that dog's useful service life, the TGTA testing takes months to complete. To make CCD more identifiable to handlers and veterinarians working with military working dogs, the next logical step is to attempt to identify behavioral and performance problems in these dogs at an early stage by means of a quick

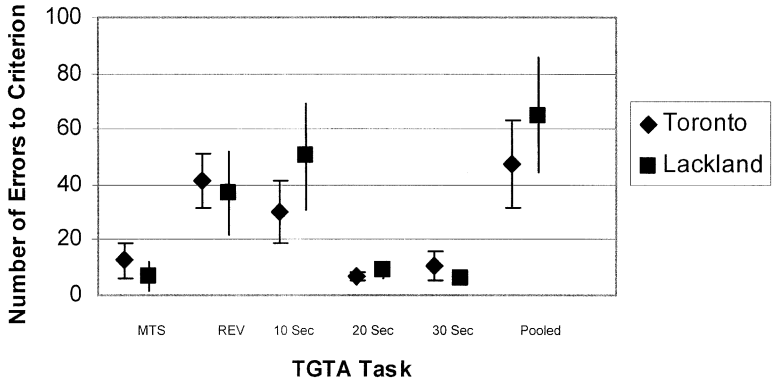

Fig. 1. Performance expressed as number of errors to criterion for Beagles (Toronto) and Military Working Dogs (Lackland) plus or minus SD. Toronto General Testing Apparatus tasks are matching to sample (MTS), reversal (REV), and delayed matching to sample (10, 20, and 30 seconds). Pooled points are for all delays.

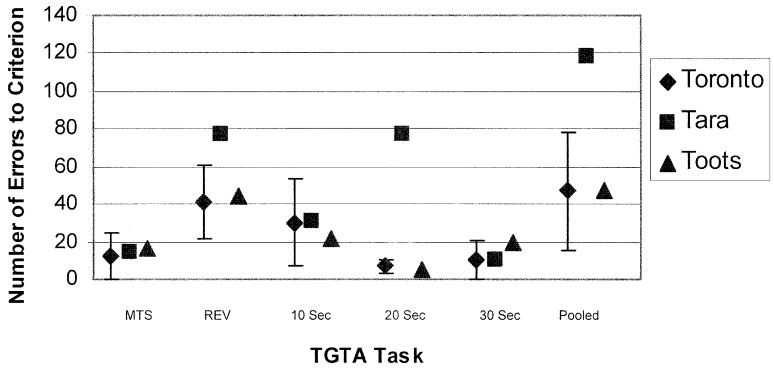

Fig. 2. Performance expressed as number of errors to criterion for Beagles (Toronto) and two aged working dogs, Tara (spayed female Labrador Retriever, aged 10 years) and Toots (spayed female Labrador Retriever, aged 12 years). Legends are the same as for Fig. 1.

screening assessment so that maximum benefit might be obtained from treatment.

The final issue addressed involves an unpublished project in which we attempted to answer some questions regarding the olfactory ability of military working dogs. Using a pure chemical, we attempted to produce training and testing objects that reliably produced incrementally smaller amounts of that pure substance when placed in a cardboard sampling container. That task in and of itself was not simple and required the services of an analytical chemist and some rather sophisticated sampling instrumentation. Fig. 3 shows the actual amounts of substance available for detection in sampling boxes for each of the four levels of aid presentation.

The behavioral issue, however, involves the questions that were asked. The first question was, ''What is the smallest available amount that a dog can reliably detect?'' The second question was, ''How specific is the

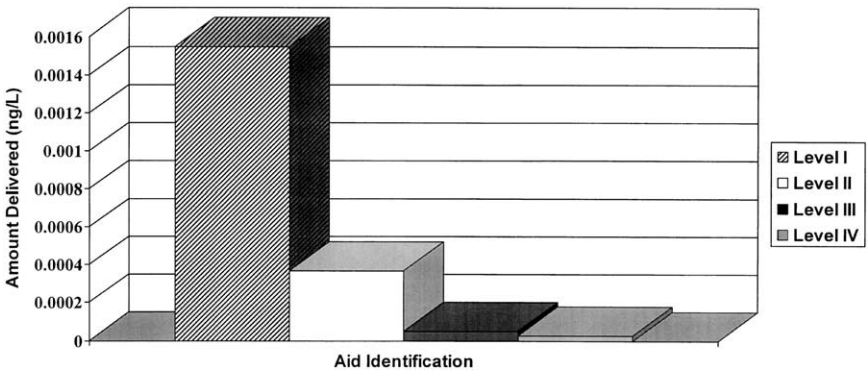

Fig. 3. Amount of training substance available in the detection sampling box as measured by polyurethane filter cartridge collection and high performance liquid chromatography assay.

detection response for the target substance?'' In this project, the dogs were trained to sample a series of sampling boxes in a square array, with random re-entry into the array on each trial. This configuration was chosen because dogs had earlier demonstrated marked place and order biases in their errors. The dogs were asked to sniff each container and then to sit if they had encountered the target substance. Varying numbers of containers contained the target material; other boxes were empty or contained ''vehicle'' (filter paper that normally contained the training substance but without any target substance on it) or a distracter (the same paper with a different substance placed on it). During training, the dogs reliably learned to detect even the lowest amount of substance present. During testing with the lowest level of target substance and with distracters and blanks, an operational problem was encountered, however. Some animals began to make mistakes, either ignoring a target (a ''miss'') or performing their sit response after sampling a box with no target material present (a ''false alarm''). A quandary arose as to whether to reward a dog for all sit responses (whether correct or incorrect) or to withhold reward during all test trials. A problem exists with either of these approaches in that the results can be confounded, because these procedures can produce new learning. If all sit responses were to be rewarded during the test, an animal would be reinforced for incorrect as well as correct responses. If results then showed that an animal did not discriminate well between target and nontarget materials, the results might have occurred because incorrect responses were rewarded (ie, responses in the presence of the nontarget substance may occur more frequently because they were being rewarded). Likewise, if reward was withheld during all test trials, correct responses would be in extinction. Poor performance might then be attributed to extinction of the previously rewarded correct response.

The solution to this problem was to perform testing in partial extinction. This was accomplished by decreasing the frequency of rewarding correct responses from 100% to 25% during the final phase of training. Unrewarded correct trials resulted in no response from the handler and no reward. During this phase of training, the handler was instructed simply to wait for a brief period after an incorrect response identified by the data recorder and then to move to the next sample location. During testing, the same lowered density of reward was used, but the rewards were given on predetermined sit responses independently of whether the response was correct or incorrect. In this way, correct and incorrect responses had an equal probability of being rewarded. This procedure also removed any potential unintentional cues that the handlers might provide if they had been aware of the correct or incorrect nature of an animal's response. The results of the test for discrimination between the test substance, blanks, vehicles, and distracters are shown in Fig. 4. The results of this project strongly suggest that the dogs formed an excellent discrimination between the target materials, empty sampling boxes, vehicle paper, and vehicle paper with an added distracting substance.

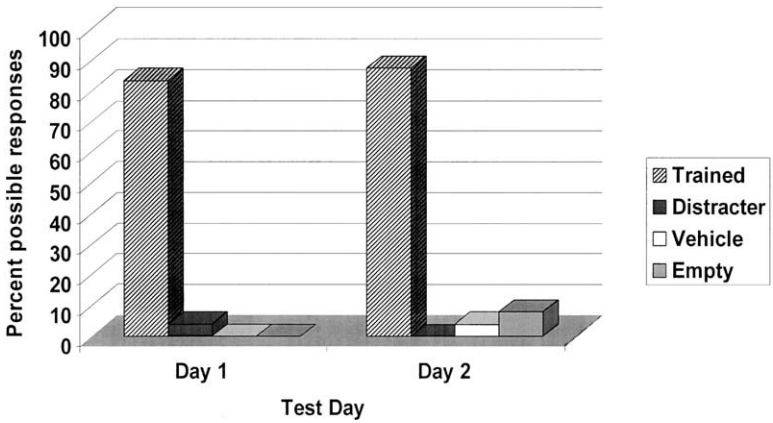

Fig. 4. Sit responses performed at sampling boxes containing previously trained pure substance on chromatography paper (Trained), a substance for which the subject had received no previous training (Distractor) also on chromatography paper, chromatography paper with no additional substance (Vehicle), or an empty sample box containing no substance or chromatography paper (Empty). Responding is recorded as sit responses as a percentage of the opportunity to sit at a station.

Taxonomy of behavioral pathologic findings

Several authors [35,36] have developed fairly in-depth taxonomies of canine behavioral problems. Most of these inventories are structured in a functional or "systems" manner. Thus, there are "ingestive" disorders, sexually dimorphic problems, problems of elimination, fearful behaviors, aggressive disorders, and the like. Odendaal [37] departs from the systems approach and suggests a classification based on etiology of a behavior, which is somewhat less dependent on the overt behavioral presentation. In this etiologic approach, behavioral problems are seen less as specific "kinds" of behavior and more as the results of genetic predisposition, developmental differences, normal variation between animals, differing kinds of social environments and cues, medical disease, variation in the ability to adapt to change, or some combination of these underlying causative agents.

Taxonomies of one sort or another serve a really useful purpose over and above providing pigeon holes in which to place a particular animal's problem or problems based on cause or appearance. One useful reason to classify behavioral problems in some functional manner is that it focuses the veterinary clinician on the general health of a patient and suggests possible dysfunctions in the physiology underlying the body system associated with the behavioral problem. For example, a veterinarian evaluating a problem of fecal house soiling is likely to perform a thorough workup of the gastrointestinal tract as part of the basic examination because of this focus [38]. Likewise, a practitioner dealing with a problem of mounting behavior

in a presumably neutered male dog is likely to perform a thorough reproductive tract examination and may expend extra effort to ensure that the patient does not have normal or retained testicles that could contribute to the problem [39].

Another reason why a taxonomic approach is useful in evaluating behavioral problems is that it allows for comparison between clinical presentations based on the presence or absence of particular behavioral and medical signs. This approach is often the way that ''syndromes'' are defined. The rationale is that similar problems may represent similar underlying pathologic characteristics and may therefore respond to similar therapy. For example, fearful behaviors, despite some variance in behavioral topography, produce a recognizable set of physical signs that are assumed to have a common underlying physiology. Because of this common physiologic response, it is reasonable to predict that behavioral problems defined as fearful are likely to benefit from the use of desensitization/counterounterconditioning or benzodiazepine anxiolytics [40].

When addressing behavioral problems in working dogs, the need for an additional system of classification arises. Functional or system-related classifications still retain their benefit in diagnosis and treatment, but three new issues arise. First, some common behavioral problems of pet dogs are not of concern in a working dog. An example would be that house soiling is not a behavior of concern in an outdoor working dog that is kenneled when not working. Second, some behavioral problems that occur in working dogs are not seen in pets. For instance, police dogs might suffer from problems involving underaggression (rather than overaggression, which would be a problem in a pet dog). Finally, by nature, working dogs are employed for specific behavioral characteristics or tasks that they perform. Especially as the complexity of a working dog program and required tasks increases, behavioral problems must be viewed in light of whether the problem interferes with the successful employment of an animal in the tasks and settings for which it is maintained.

A classification scheme for behavioral problems in working dogs that accounts for these factors reclassifies behavioral problems into four categories for the purpose of effectively dealing with case management. The first category includes those behavioral characteristics or problems that interfere with the acquisition of a required task. These kinds of problems might be called ''learning-related problems.'' The second category includes behavioral issues that directly interfere with the performance of a previously proficient task. These kinds of problems might be considered as ''performance problems.'' The third category is composed of behaviors that do not directly interfere with a required task but that indirectly degrade task performance because of their presence. These problems might be referred to as ''disruptive problems.'' The final category is composed of behavioral problems or characteristics that do not affect the acquisition or performance of required tasks but constitute a danger to the well-being of the patient,

other animals, or human beings and might be referred to as "husbandry problems."

Learning-related problems could run the gamut from medical and anatomic difficulties that produce untoward effects on learning to problems of aptitude or temperament. Some obvious examples of these kinds of medical problems with behavioral signs are anosmia, lissencephaly, blindness, and the like [41]. Other less obvious problems might include difficulty in acquiring and maintaining an animal's attention such that it cannot successfully practice and be rewarded for correct performance of a behavioral task, inability to entice an animal to perform a required behavior using available reinforcers, or an apparent lack of aptitude (either physically or "intellectually") for performing a particular task. For the purposes of case management, it should be noted that these kinds of problems are most frequently encountered during animal selection or initial training and rarely thereafter. In addition, more often than not, these kinds of problems should result in the elimination of a candidate animal from consideration or training, because substantive changes in basic temperament and aptitude can rarely be expected [24].

Performance problems would be expected to occur in dogs that had successfully acquired and performed a required behavior at some time but that now have become unable or unwilling to perform that behavior. These types of behavioral problems might occur in dogs that have temporary or permanent adverse changes in sensory ability or other physical problems, such as a detector dog that is unable to find a target item by smell because of a viral rhinitis, a patient demonstrating a decrement in task performance secondary to the administration of a medication, or an animal no longer able to meet the physical demands of its tasking as a helper dog because of peripheral neurodegenerative disease or arthritis. These types of problems might also occur in animals that display an apparent loss of learned task performance in association with signs of a central neurodegenerative disorder, such as CCD [34]. Unlike learning-related problems, performance problems are more likely to be associated with a medical condition or behavioral problem that is at least theoretically treatable. Case management would be focused on identifying the specific cause of performance failure through a thorough medical evaluation and a behavioral task analysis and on resolving or accommodating for the causative condition or conditions. Behavioral management is often accomplished through a remedial training plan.

Disruptive problems interrupt the ongoing performance of a required behavior (rather than affecting the underlying ability to perform a behavior) and often involve a behavior other than that which is usually related to the successful performance of the task. A simple example of a disruptive behavioral problem is the situation where a search and rescue dog becomes distracted by and begins to chase a wild animal during a search, effectively preventing successful completion of a search pattern. Another example is

a drug or explosives detection dog that becomes distracted by a food item during a search, resulting in an incorrect response. These disruptive behavioral problems also include behaviors that are truly considered behavioral pathologic findings and are completely unrelated to the task at hand. Examples include repetitive tail-chasing in a helper dog and (apparently) untriggered aggression toward human beings in a detector dog searching luggage. Rather than task analysis and retraining, these cases usually benefit more from specifically addressing the disrupting behavioral problem and successfully managing it.

Husbandry problems include behaviors like generalized overactivity intense and persistent enough to interfere with the ability of an animal to maintain a healthy body weight or a patient that engages in repetitive spinning when not performing a required task and subsequently injures itself. Included in this category are also behaviors that are seen as problems in pets, such as attempts to escape from a location or secondary self-injury during a thunderstorm or undesired aggressiveness directed toward people or other animals in social nonwork settings (eg, on walks, while grooming, during other routine handling). Like disruptive behaviors, husbandry problems are best managed by directly addressing and managing the problem behaviors, although husbandry problems often provide the practitioner with more time for case management, because the problems do not directly disrupt task performance.

This classification and discussion of behavioral problems in working dogs focuses heavily on problems associated with the acquisition and performance of task-related behaviors and on the safety of people and other animals exposed to the working dog. The classification scheme also focuses on the well-being of the working dog itself in that behaviors that clearly cause harm to the working dog are seen as husbandry problems. This strategy, however, seems to downplay behaviors that might be considered abnormal in a systems approach if those behaviors do not adversely affect learning or performance or unless they cause an imminent risk to health or safety. In some ways, this observation is true. The working dog classification outlined here would not necessarily identify repetitive behaviors (eg, spinning or barking) as problems unless they resulted in an inability to acquire a required behavior, if the repetitive behavior disrupted a required task as it was being performed, or if the behavior caused injury or illness in associated people, other animals, or the patient itself. Likewise, an intact male dog with a strong proclivity to urine-mark repetitively, display aggression toward other male dogs, or mount objects might not be considered as problematic if that dog was never brought indoors (and there was nothing to be damaged by mounting or marking) and never encountered other dogs. Ignoring the presence of behaviors that might be considered abnormal or unacceptable in pet dogs raises a question as to whether the strategy, if rigidly applied, might be harmful to the long-term welfare of an animal.

In reply to this question, the first point to note is that successful working dog handlers are aware and communicative regarding what they consider abnormal or unacceptable in their animals and are aware and strong advocates for the well-being of their animals [42]. Depending on the housing and employment style (a significant number of working dogs live with their handlers and work indoors and in close proximity to other animals and people), working dogs may be presented for the same kinds of behavioral problems as pet dogs, and these problems are often not ones that interfere with task, life, limb, or property. Secondly, this working dog behavioral problem classification is meant to extend rather than to replace traditional behavioral taxonomies. It is intended to focus on task-related problems, potentially as the result of treatable medical condition(s) and then as behavioral problems worthy of the application of applied behavioral analysis and medical and behavioral management and not as the inevitable result of factors like poor breeding, bad temperament, neglectful or abusive rearing, fatal training failures, or age-related "performance-failure," which should result only in eliminating an animal from a program.

Some behavioral problems of working dogs

Most reviews of behavioral problems in a particular setting or in a particular species include a summary of the demographics of the population served and a description of the kinds of behavioral problems commonly identified. In a behavioral referral practice serving pet dogs and cats, one might summarize the most frequently encountered behavioral problems as those that produce risk to life, limb, or property [43,44].

The Military Working Dog Veterinary Service Behavioral Medicine Section has a referral population of approximately 1500 military working dogs located at more than 200 locations around the world. Currently, Belgian Malinois Dogs represent approximately 50% of the population and German Shepherd Dogs comprise about 37% of the population (Fig. 5). The range of ages in the population as of October 1, 2000, was birth to 15 years of age (Fig. 6), and the median age was 8.2 years. Intact male dogs comprise about 55% of the population, whereas about 23% of the animals are neutered male dogs (Fig. 7). Virtually all the 18% of the population that are female are also spayed (intact female dogs are maintained only for the current breeding program). This profile differs significantly from that of other population bases described previously (eg, Landsberg [43]). In the US Department of Defense military working dog, only a few breeds are represented, the ratio of male to female dogs does not parallel the typical referral base (with male dogs being disproportionately represented), and the proportion of intact versus neutered animals also differs from a typical veterinary practice in the United States (with intact male dogs and spayed female dogs being disproportionately represented).

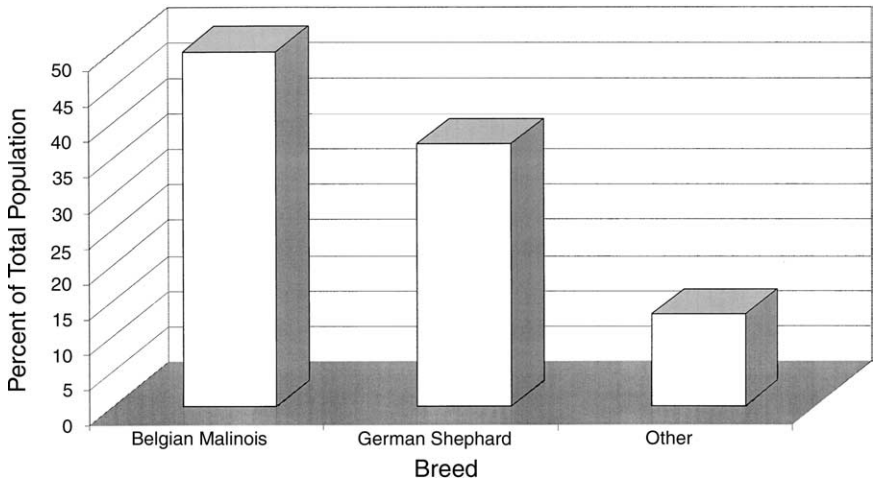

Fig. 5. Breed distribution of US military working dogs as of October 2000 expressed as percentage of total population.

In a recent review of the medical records of 927 military working dogs that were humanely euthanized between 1993 and 1996 [45], the attending veterinarian cited a behavioral problem (overwhelmingly, inappropriate aggression) as the primary reason for euthanasia in 18 cases or 2% of the total (see Fig. 2). During the same period, however, another 130 dogs (14%) were euthanized for what the authors extracted as ''geriatric decline'' and another 8 (0.9%) were euthanized for ''brain diseases,'' whereas a primary reason for the decision to euthanize the dog could not be adequately determined from the medical record for 42 additional cases (4.5%). It is not

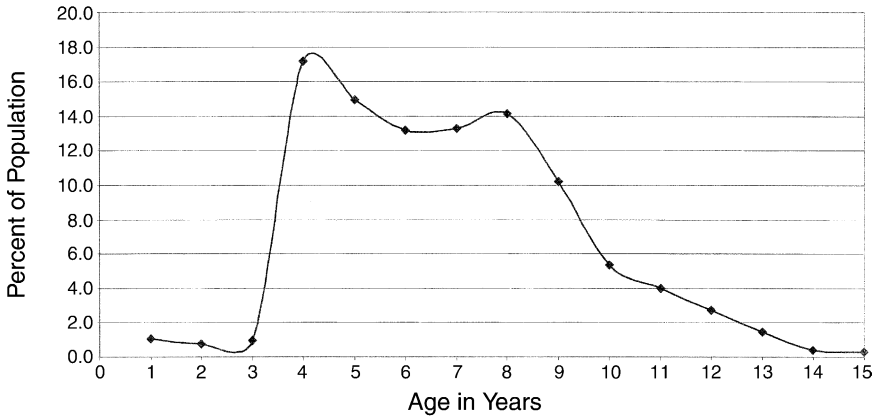

Fig. 6. Age distribution of US military working dogs as of October 2000 expressed as percentage of total population. Whole year ages (eg, 3.0 years) are midpoints of each year group (eg, 2.50–3.49 years).

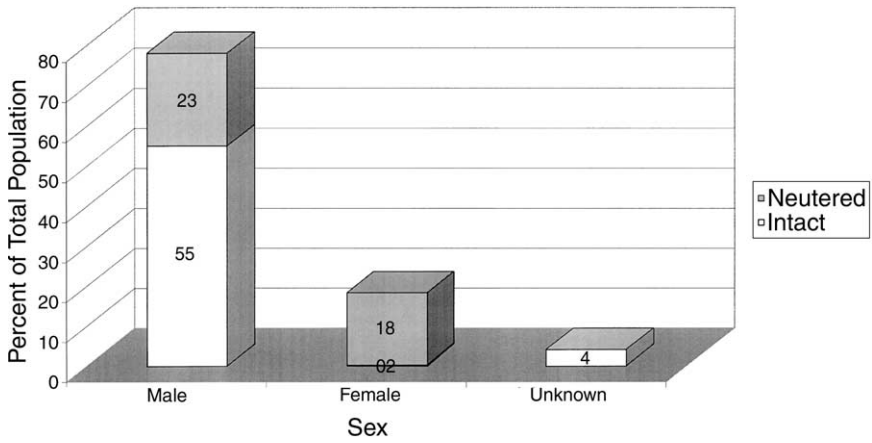

Fig. 7. Sex and reproductive status for US military working dogs as of October 2000 expressed as percentage of total population. Note that 0.2% of female dogs were intact and that sex and reproductive status were unavailable in the database for 4.0% of the population.

unreasonable to speculate that a number of the geriatric decline (and possibly brain disease) cases might have had one or more behavioral signs as a significant part of their presenting complaint. It should be re-emphasized that these data are on the primary reason for spontaneous death or the decision to perform humane euthanasia and are not measures of incidence of any of the kinds of conditions listed. Also, additional reasons used in the decision to consider humane euthanasia as the best course of treatment for any patient (eg, comorbidity of neoplasia and some significant behavioral problem) were not evaluated in the cited paper.

In an unpublished preliminary evaluation of a series of 60 behavioral consultations and referrals in military working dogs presented at the Department of Defense Military Working Dog Veterinary Service Behavioral Medicine Section, 80 individual behavioral complaints (an average of 1.3 behavioral complaints per patient) were recorded on the master problem lists (Fig. 8).

The most commonly presented behavioral complaints were problems involving aggression, representing over 30% of all the complaints. In this group of problems, most patients exhibited excessive aggression in inappropriate settings or toward unacceptable targets, such as the dog's own handler. These behavioral problems involving excessive or inappropriate aggression usually met the criteria for classification as disruptive problems (indirectly interfering with task performance), although some, such as aggressiveness directed at the handler when kenneling, could better be classified as husbandry problems. Only two complaints in this series were presented for a problem of insufficient aggression, classified as learning-related problems because they prevented acquisition of a required controlled aggression task.

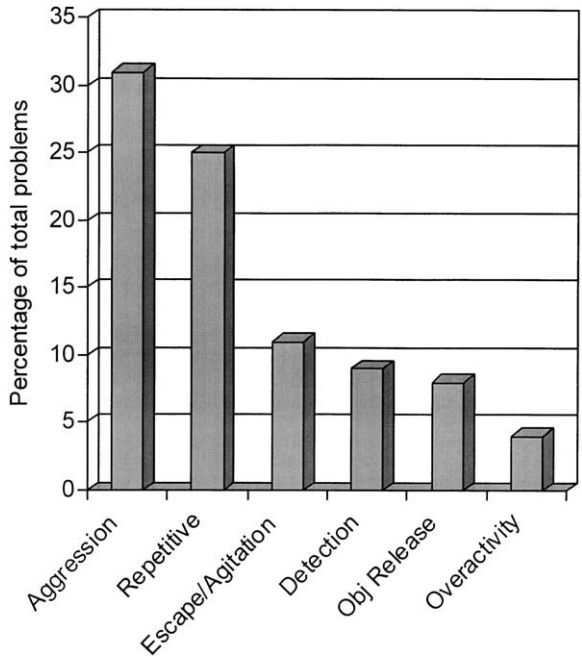

Fig. 8. Summary of clinical presentations for 80 behavioral problems identified in 60 military working dogs randomly selected by behavioral case record. Aggression = inappropriate aggression directed toward human beings; repetitive = repetitive behaviors; escape/agitation = situationally related agitation and attempts to escape; detection = failure to detect a previously "known" substance; obj release = failure to release a reward object on command; overactivity = excessive activity interfering with task performance.

Twenty-five percent of the complaints involved patients displaying repetitive behaviors that were either disruptive or constituted husbandry problems. The most common repetitive behavior was repetitive spinning (rapidly ambulating in a tight circle). Of patients displaying spinning behavior, most were Belgian Malinois Dogs, and most of these patients were presented because of self-trauma caused by the behavior. Only a few of the patients displayed spinning that was disruptive of task performance. Other problem repetitive behaviors were repetitive licking and chewing and biting of self, with or without secondary trauma. One unusual case involved a patient that repetitively and persistently grasped its prepuce or scrotum in its teeth, vocalized quietly, and stayed in one position for long periods. Fortunately, this was a patient that had not yet been purchased for the program, and it was returned to its owner without further diagnosis. It might be noted that one article describes as a valuable characteristic the increased energy and stamina of Belgian Malinois Dogs for US military service [46] compared with the German Shepard Dog, which had previously been the breed of choice.

Another 12% of the complaints represented situations in which animals became aroused or agitated and attempted to retreat, escape from, or avoid a situation or stimulus. Identifiable situations and stimuli producing this escape and avoidance behavior were specific kinds of flooring surfaces (particularly smooth surfaces), loud noises (especially gunfire and the operation of small arms without discharge), thunderstorm-related cues, industrial noise, and the presence of certain individuals. Dogs displaying this avoidance behavior when exposed to gunfire are particularly interesting, because all military working dogs are initially procured only if they display a neutral response to weapons fire. These dogs are also extensively exposed to weapons fire during maintenance training so as to maintain their neutrality in behavioral response. When escape and avoidance behavior to gunfire developed in these cases, the behavior was extremely disruptive to task performance and often resulted in the patient being eliminated from further use as a military working dog. Likewise, avoidance of people, surfaces, industrial noise, and storms usually developed as a problem in adult dogs that had not previously shown avoidance responding in similar situations.

Approximately 9% of the behavioral complaints involved a specific disruption of a patient's performance in substance detection. These problems were reported both as learning-related problems in which a patient could not progress successfully in initial training and as later failure of patients previously proficient in detection work. Detection problems were described both for patients that did not respond with sufficient reliability in the presence of a substance for which they were trained to respond (misses) and for mistakes in which patients responded in the absence of a target substance (false alarms). Observation of these patients' detection performance revealed that some animals appeared to rely too heavily on cues provided (unconsciously) by the handler during training, dissociation between substance identification and responding to obtain reward (anticipatory responding), fatigue and associated panting during task performance (resulting in less olfactory exposure to olfactory cues), and inattention to task (increased distractibility). Anosmia was not demonstrated in any of the cases.

Approximately 8% of the problems presented involved a problem unique to dogs trained to perform detection and controlled aggression tasks. This problem involved the unwillingness of patients to release or relinquish an object on command. These "release" problems in some ways look like object guarding in pet dogs, but they are usually limited to situations where the dog is holding a reward object (reward toy or bite sleeve) in its mouth, and the possessive behaviors are usually of much greater intensity than problems seen in pets. Trainers and handlers often call these presentations "out" problems (the command to release a toy or a bite is often "out"). Dogs that do not release a bite sleeve or suit are called "wrap-happy" (the bite sleeve is often called a "wrap"). These problems can present with or without an aggressive component (cases where the patient displays aggression in an attempt to avoid relinquishing an object were not included in the aggressive

behavioral problems discussed previously). These complaints most often arise during initial training, so they may be classified as learning-related problems. Some patients, however, were presented after successful training and varying amounts of successful task performance as having performance problems. Anecdotally, some of the problems involving relinquishment of reward objects during substance detection training or employment were addressed and resolved easily by switching the patient's reward to a food object that could be quickly consumed. Relinquishment problems involving bite equipment were often extremely difficult to address by the time a dog was presented for treatment. Interestingly, one of the key factors used to select a candidate adult animal for military service is the animal's pursuit of and interaction with toys.

Finally, 4% of the complaints were for overactivity and distractibility, often in apparently successfully trained animals, and were presented as performance problems. Overactivity was occasionally identified in animals during initial training as a learning-related problem. Animals presented for overactivity often had difficulty in maintaining their focus on task performance and became distracted by people and events that occurred around them. When presented during training, some of these patients were described as "slow learners," and the overactivity problem often coexisted with problems of repetitive behavior. In an ongoing series of cases not included in this survey, dogs showing signs of overactivity were often presented initially for failure to maintain optimal body condition scores despite apparently good health and adequate ingestion of a performance diet.

Not included in this reviewed series of cases but identified with some regularity as problems in military working dogs are separation-related behavioral problems, CCD, forging and lunging on the leash and poor obedience compliance, unacceptable urination and defecation in work settings, urine-marking in work settings, and excessive interdog aggression.

Approach to behavioral therapy

In examining some aspects of behavioral therapy in working dogs, it may be illuminating to identify some of the challenges. Behavioral therapy in working dogs can be anything from routine to challenging. Many problems common to working dogs and pet dogs are managed in much the same way in both settings, often with good outcomes. The fact that working dogs support organizations with specific missions and the presence of critical working behaviors in the individual patient add several dimensions to the behavioral management of working dogs.

One challenge in working dog behavioral therapy involves the fundamental decision whether to diagnose and treat a behavioral problem. Although pet owners in some ways perform a cost-benefit analysis when deciding on their pet's spectrum of medical and behavioral care (eg, "price-

shopping'' for veterinary care), the average owner usually makes decisions on care primarily on the basis of the welfare and comfort of the pet [47,48]. In an organized working dog program (especially in large-scale programs), however, the comfort and welfare of the individual animal may at times compete with the needs of the program to produce and maintain a sufficient number of animals that are capable of successfully performing the critical tasks associated with their employment. Thus, when considering treatment options for a working dog, additional emphasis is placed on determining the likelihood of successfully managing (ideally, curing) a behavioral problem so that it does not prevent successful completion of a patient's normal duties. Time lost from work (for both the dog and its handler) while initially treating a behavioral problem may also become a critical concern, as might the amount of time and other costs of managing an animal with a behavioral problem requiring long-term management.

These management decisions are not made lightly in any large-scale program. The initial investment in candidate animals is often quite significant, regardless of whether candidate dogs are purchased or produced through a breeding program. Training time is extensive and costly, and the need for an unanticipated replacement of an animal may cost the user the services of a dog for weeks or even months while awaiting a trained replacement.

Both in private practice and in working dog programs, when dogs pose a significant safety risk to themselves or others, humane euthanasia is sometimes contemplated. In pet practice, some surveys [49,50] suggest that owners are willing to tolerate many less severe behavioral problems either without any behavioral treatment or after one or more unsuccessful attempts to manage a problem. In contrast, military working dogs with less severe behavioral problems may be removed from active service (with or without attempts at behavioral treatment) but retained by the program to help train military dog handlers. These dogs may also be reallocated from the military to other governmental canine programs, where they might be able to perform successfully despite the presence of a mild to moderate behavioral fault, or they may be granted to a civilian law enforcement agency for use. Recently, legislation (Public Law 106-446) has been enacted that allows the US military to adopt ''excess'' military working dogs out to individuals (previously, aggression-trained military working dogs were considered to be unadoptable). This adoption process now provides another method to ''retire'' military dogs with mild to moderate behavioral problems that do not have an impact on the safety or welfare of the patients themselves or others.

Working dog handlers are often extremely involved in their dog's care and highly motivated to assist [42]. Nonetheless, treatment failure for behavioral problems in working dogs probably approaches rates for pet dogs experienced in other settings, although data on outcomes from any therapeutic setting are fairly limited. It is likely that the single most important factor resulting in failure of a behavioral plan in working dogs is

that of poor compliance with the plan. Factors contributing to this cause of treatment failure likely include issues similar to those experienced in pet behavioral therapy, such as a perception that the prognosis for successful resolution or management of the problem is low; too much time is required to execute the behavioral plan; the plan is excessively disruptive of normal activities; poor understanding of methods to be applied as part of the treatment plan; excessive cost of medications, equipment, or supplies required to follow the treatment plan; inadequate follow-up in support of the treatment plan; or inability to observe significant positive behavioral change in the patient within a reasonable period of time.

Especially in working dogs (but also applicable to pet behavioral therapy), the initial assessment of a behavioral problem may lack a clear-cut identification of the specific unacceptable behaviors that are present or the required behaviors that cannot be obtained from the patient. This step is important with working dogs, because a lack of detail makes it difficult to identify specific alternative behaviors with which to replace specific unacceptable behaviors, leaves the behavioral plan without specific steps to reduce the production of specific unacceptable behaviors and increase the probability of desired behaviors through reinforced practice (and other means), and leaves the team without clear and measurable intermediate criteria for determining if the therapy is successful. Particularly when working with skilled trainers and handlers, especially when attempting to manage a case through an attending veterinarian at a physically remote location, the better defined a behavioral plan can be made (not necessarily more complicated), the more likely it is that treatment compliance can be obtained. Anecdotally, treatment compliance can often be enhanced with regularly scheduled recheck appointments, especially if structured evaluation of behavioral progress can be incorporated into the recheck.

As mentioned several times previously, treating behavioral problems in working dogs takes on several dimensions not usually experienced in pet dogs. For example, diagnosis and treatment for a behavioral problem may not be pursued because of a limitation in time or other resources required to address a problem. Even in an ideal situation, where treating a behavioral problem in a working dog may be seen as highly desirable, special accommodations may need to be made to allow the animal to continue working during treatment. Alternatively, plans may need to be made to allow an animal to be out of training or duty for all or part of the time treatment is attempted to ensure that performance on critical tasks is not compromised. This is an important issue, because working dogs may be charged with protecting human life (eg, police dogs, Seeing Eye dogs, bomb-detector dogs, search and rescue dogs) and failure in a task may be fatal. In addition, legal issues may exist in one or more aspects of a dog's employment. For example, courts have entertained arguments suggesting that the presence of any sort of ongoing treatment (especially medications) in a drug detection dog might compromise the ability of the animal to

perform its detection task accurately, thus weakening the value of the dog team's "testimony" when a detection response is made (Dan Craig, DVM, MA, San Antonio, TX, personal communication, 2002).

Drug therapy in working dogs

One particular consideration in the behavioral treatment of working dogs is the use of psychoactive drugs in an animal that needs to work during treatment. There are several problems that arise in this setting. The first potential problem is that using a medication in a working dog may have direct adverse effects on the physical performance of a required behavior. Examples of this problem include the obvious example of the potential adverse effects of a muscle relaxant on the performance of an agility task [51]. Other drugs may blunt sensory abilities. Examples include the effects of adrenergic and noradrenergic drugs on vision [52] and olfactory degradation by some corticosteroids (eg, Kavaliers and Ossenkopp [53]). Some medications may have undesirable effects on learning, memory, and performance. For example, benzodiazepines may exert an amnesic effect and disrupt learning [54], selegiline may increase errors and trials to criterion on certain tasks in normal dogs [55], and methylphenidate can increase reaction time and errors on some tasks and in some animals [56].

There are two issues regarding the use of drugs in working dogs that go well beyond concerns of pet owners. First, there has been almost no systematic work done to evaluate the effects of most medications on "normal" canine maintenance or social behaviors or on the learning, memory, and accurate performance of working dog tasks. Much of the human and laboratory animal psychopharmacology research of the past 50 years [57] suggests that most psychotropics (and many other drugs not necessarily considered psychotropic medications) produce dose-dependent effects on the production of a wide variety of learned and species-typical behaviors maintained by diverse schedules of reinforcement and cued by diverse intrinsic and extrinsic stimuli. Coupled with the fact that most drugs used in canine behavioral therapy are still considered extralabel uses, significant questions arise regarding temporary or permanent task-related disruption that may occur when psychotropics are used in working dogs.

The second issue that arises is the possibility of state-dependent learning. This phenomenon was first described experimentally in a setting where animal or human subjects were trained to perform a novel task successfully when under the influence of a drug (eg, Jackson [54]). These subjects, when tested later under the influence of the drug, were able to perform the task successfully. When retested with no drug present, however, the subjects showed a marked degradation in their ability to perform the task. When a benzodiazepine is used as the drug during training, the degradation in performance has traditionally been called an "amnesic" effect, implying

that the subjects correctly learned the required behavior when under the influence of the drug but forgot how to perform the task when no drug was present (this serves as a model for a clinical amnesic effect in human beings and has been used to explain recurrence of symptoms in benzodiazepine-treated patients after withdrawal of their medication). The basic finding, however, has been reproduced using other drugs and tasks. Some of the drugs producing state-dependent learning do not have obvious sedative, hypnotic, or amnesic clinical effects. In these models, the drug seems to have acquired the characteristics of a discriminative stimulus for the performance of the behavior learned under its influence. Regardless of whether a drug serves as a discriminative stimulus or has direct action on learning, memory, or performance, the possibility of this phenomenon occurring in the context of task training or performance raises another red flag that demands further evaluation of psychotropics in situations involving skilled canine tasks.

Nevertheless, psychotropic drugs can be and are used in working dogs provided that some precautions are exercised. First, it should be considered unwise to administer a psychotropic drug (or other medications with potential sensory, neurologic, or behavioral side effects) acutely to a dog required to perform a critical task with safety concerns. As much as possible, behavioral medications should be administered in a nonwork setting, used to obtain desired effects, tapered to a minimum effective dose as soon as is possible, and withdrawn according to currently recommended schedules as soon as they are no longer critical to therapy.

Sample cases

Several applications of pharmacotherapy in case management involving working dogs may be useful in illustrating how behavioral drugs might be applied and their effects assessed in these patients.

The first case involved a Ori, a 3-year-old intact male German Shepherd Dog that was experiencing difficulty in progressing in substance detection training because of excessive distractibility triggered by the presence of people during training trials. The patient also engaged in repetitive spinning in the home cage and had difficulty in maintaining body condition despite adequate nutrition. The patient had no active major medical problems. The patient's presentation and clinical assessment indicated moderate overactivity and distractibility categorized as learning-related problems and moderate intermittent repetitive spinning in the home kennel and poor body condition (3/9) categorized as husbandry problems. The undesirable behaviors included excessive movement at rest, breaking a search pattern when distracted by people, and repetitive spinning in the home kennel. Desired behaviors were relaxed stand, sit, and down with minimal physical restraint; completion of search pattern from start to finish with required

sensitivity and specificity; and patient engaging in sedentary recreational behaviors in kennel. A 3-day trial using 0, 0.25, and 0.5 mg/lb of methylphenidate [58] was conducted to assess whether the patient would benefit from this drug (Fig. 9). Results of the assessment suggested that the patient might benefit from methylphenidate at a dose of 0.25 mg/lb. At that dose (but not at 0 or 0.5 mg/lb), the patient displayed both a decrease in heart rate of 10 beats per minute (bpm) and a decrease in overall activity (''attitude'') as rated by a masked evaluator. A trial course of the 40 mg of methylphenidate administered by mouth twice daily was prescribed for a period of 14 days. Because there were no safety contraindications, the patient was continued in training with the recommendation that the handler

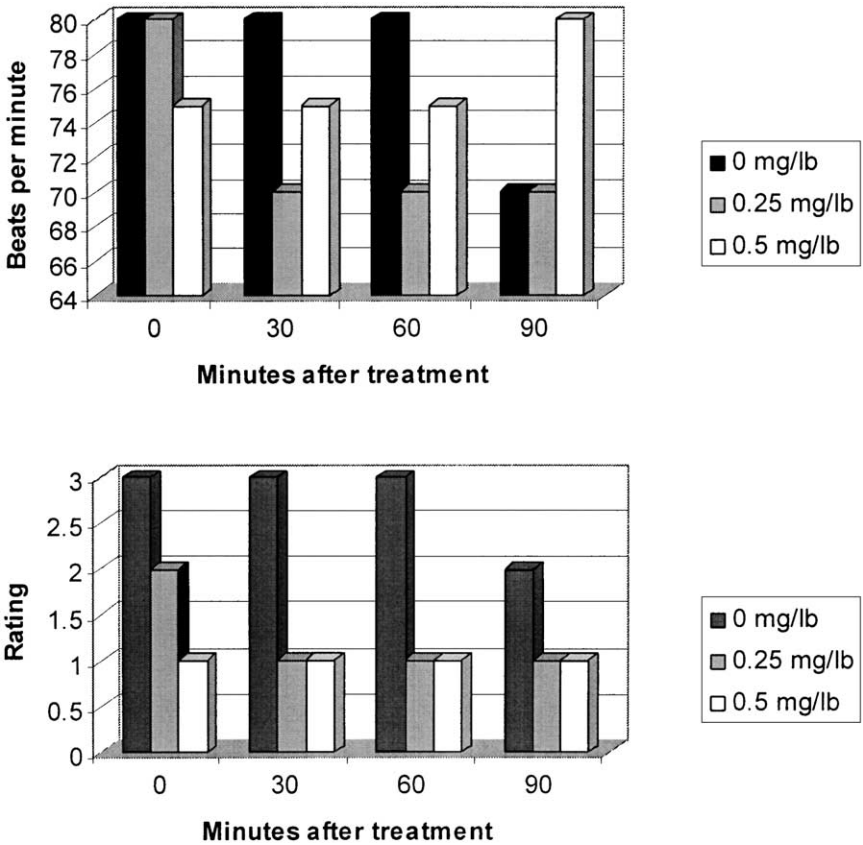

Fig. 9. Methylphenidate response test data from a single patient. Heart rate and attitude rating measured before treatment and at 30, 60, and 90 minutes after treatment with 0, 0.25, and 0.5 mg of methylphenidate given orally. Attitude is rated as sedate (0), calm (1), active (2), or agitated (3).

return to shorter search patterns, attempt to complete these patterns both with and without distractions, and when successful, gradually increase the length of the pattern to that required for certification. The handler was contacted frequently by the veterinary behavioral technician to determine whether the patient was performing acceptably. Reassessment was planned if the trainer continued to experience problems. The patient was provided a Buster Cube in the home kennel as an item of environmental enrichment and to provide a more sedate alternative behavior to spinning. The veterinary behavioral technician manipulated the toy in the presence of the patient and made the toy available with differing contents on different days to make it more attractive to the patient. The patient's weight was monitored weekly. Spinning was measured as the amount of time engaged in the activity, measured for 10 minutes twice each week at the same time of day.

After 2 weeks of medication trial, the trainer reported that the patient was progressing successfully in training and that the patient would stand, sit, and down without excessive movement. The patient had gained 3 lb. Although the patient interacted with the Buster Cube infrequently, spinning had almost completely resolved by the second assessment.

At 4 weeks, the patient's body condition score was 4 of 9 and its weight was within the normal weight range. Training had continued to progress well, and the patient stood, sat, and "downed" to the trainer's satisfaction. Caretakers noted that the patient would engage in spinning for a few seconds when returned to its kennel from a walk or grooming but then would immediately settle.

At 8 weeks, the patient was noted to be spinning for the entire 10-minute measurement period. A check noted that the patient had run out of medication 3 days earlier and that the prescription had not been refilled. The trainer did not report any training problems, and the dog was readying for a certification test. The dog's weight had stabilized within the ideal range, and the patient had a body condition score of 4 of 9. The medications were refilled, and the spinning disappeared on re-evaluation the next day.

At 16 weeks, the patient had certified and was transferred to operational use. The attending veterinarian was advised to maintain medication, monitor the patient's body condition score once weekly, and review the animal's performance with the kennel master and the dog's handler at least monthly. The veterinarian was advised to contact the Behavior Medicine Section if any questions or problems arose and to consider quarterly "drug vacations" to assess whether continued therapy was indicated. At last follow-up, the patient was performing well and was still on 0.25 mg/lb of methylphenidate twice daily.

A second case involved Bruno, a 2-year-old intact male German Shepherd Dog in training, with a presentation similar to the previous case. In addition, this patient stool soiled its home kennel daily and demonstrated tremor associated with elevated activity and vigilance as well as some apprehension (freezing and retreat) during training sessions. This patient

was tested with methylphenidate in a similar manner as in the previous case but with equivocal results. A 3-week trial of clomipramine (0.5 mg/kg administered orally twice daily) indicated that the patient might benefit from the drug because its weight began to stabilize and the trainer indicated that the patient was somewhat more tractable.

Unfortunately, this patient was also extremely difficult to medicate. Conventional therapy with oral medications in large kennels of military working dogs involves hiding the drug in a small amount of canned food, but this patient did not eat canned food at all (even with 12-hour deprivation). This patient was also resistant to head handling, making oral dosing impossible. Because twice-daily or even daily administration of a medication was not possible, an alternative was sought. Fluoxetine has recently been approved for human use on a once-weekly basis (Prozac Weekly). The product monograph indicates that the effectiveness is not based on release of the drug over an extended period of time. Rather, the drug is given at a much higher dose than on the daily regimen (80 mg versus 20 mg), and beneficial effects are a result of blood levels of norfluoxetine, a metabolite with a relatively long half-life.

Adequate pharmacokinetics were not available for the dog [59], so we evaluated the levels of fluoxetine and norfluoxetine in the serum of this patient for a week after the administration of a single 80-mg dose (0.5 mg/kg) of fluoxetine (Fig. 10). Fluoxetine levels rose to slightly over 40 ng/mL on day 1 but decreased to nondetectable levels thereafter. Norfluoxetine rose to almost 100 ng/mL on day 1 and then decreased much more slowly. An estimation of its half-life in the dog from these data is

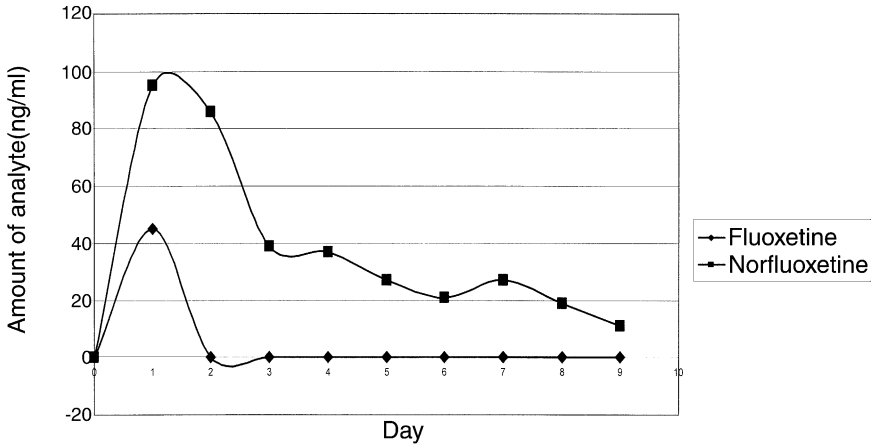

Fig. 10. Serum levels (in nanograms per milliliter) of fluoxetine and norfluoxetine measured before and at daily intervals after the oral administration of 80 mg (1 mg/lb) of fluoxetine in a 3-year-old intact male Belgian Malinois military working dog. The lines connecting the daily sample values have been smoothed by computer algorithm.

approximately 2 to 3 days. Anecdotally, beneficial behavioral effects were noted in this patient on days 1 through 3 (but not on day 4), suggesting that the effective dose of norfluoxetine was in excess of 40 ng/mL in this patient.

Unfortunately, treatment was not successful in this patient, because even weekly treatments were next to impossible. The patient was eliminated from training and was transferred to another use.

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