DISSERTATION

EVALUATION OF TEMPERAMENT INFORMATION TO IMPROVE ADOPTION OCCURRENCE AND EVALUATION OF HUMAN CONTACT AND HOUSING ARRANGEMENT ON STRESS RESPONSE OF ADULT SHELTER DOGS

Submitted by

Crista L. Coppola

Animal Sciences Department

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY CRISTA L. COPPOLA ENTITLED EVALUATION OF TEMPERAMENT INFORMATION TO IMPROVE ADOPTION OCCURRENCE AND EVALUATION OF HUMAN CONTACT AND HOUSING ARRANGEMENT ON STRESS RESPONSE OF ADULT SHELTER DOGS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTORATE OF PHILOSOPHY.

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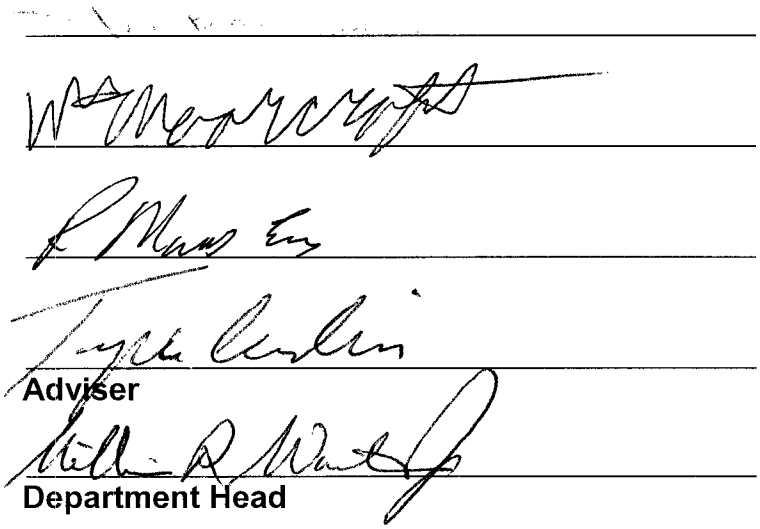

Adviser

Department Head

ABSTRACT OF DISSERTATION

EVALUATION OF TEMPERAMENT INFORMATION TO IMPROVE ADOPTION OCCURRENCE AND EVALUATION OF HUMAN CONTACT AND HOUSING ARRANGEMENT ON STRESS RESPONSE OF ADULT SHELTER DOGS

A high proportion of dogs will spend an indeterminate period of time in an animal shelter, either waiting to be claimed by their owner, waiting to be adopted or waiting to be euthanized. For a dog, an animal shelter is an extremely stressful environment. An animal shelter incorporates two of the main psychological stressors for dogs, lack of social contact and novel, unpredictable surroundings. This study was designed to determine if adoption numbers, time to adoption and adoption satisfaction could be improved through the utilization of available temperament information. This study also examined factors affecting stress response, as measured by salivary cortisol. The adoption experiment involved 88 adult, stray dogs available for adoption (48 treatment and 40 control). The treatment dogs were made available for adoption with name, approximate age, sex and applicable temperament information accessible to the general public. Control dogs were available for adoption with name, approximate age, sex and estimated breed(s) information accessible. Treatment dogs were adopted more often and more quickly (P= 0.036 and 0.033, respectively) than control dogs. Sixty-three percent of the treatment dogs were adopted in an average of 5.64 days while only thirty-seven percent of the control dogs were adopted in an average of 7.05 days. The same animals were utilized in a second

experiment to determine the effect of human contact on stress response. The treatment dogs from the first experiment engaged in a 30-45 minute human contact session on the second day after arrival to the shelter while control dogs did not engage in a scheduled human contact session. There was a considerable difference in stress response measured on day 3 between the two groups (P= 0.014). Treatment dogs' cortisol level was 36% lower than the control dogs on day 3. The third experiment examined the effect of pair housing on stress response. This experiment utilized 54 adult shelter dogs that had been housed in the shelter for at least nine days. The dogs were housed either alone or with another dog in identical kennels in the same adoption area. Dogs housed alone had numerically higher cortisol levels than dogs housed in pairs but no significant differences were detected (P> 0.05). Based on these results, it was concluded that the adoption process could be improved by providing temperament information and stress response could be reduced when human interaction is implemented on the second day of housing in the shelter.

Crista Leigh Coppola
Animal Sciences Department
Colorado State University
Fort Collins, CO 80523
Spring 2004

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I have done my best. I have completed my journey and now I am ready.

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INTRODUCTION

Canines have been a part of human society longer than any other domesticated species. They have made themselves a home inside millions of households and have been widely accepted as "man's best friend". Yet sadly, every year in the United States, 3-5 million dogs are euthanized (www.aspca.org, 2003). Animal shelters receive an estimated 8-12 million companion animals each year and less than half are successfully adopted (www.aspca.org, 2003). Identifying the factors that affect whether an animal is adopted from a shelter can be beneficial in increasing the number of animals adopted by the community and ultimately decreasing the number of animals killed.

Approximately 20% of the shelter dog population is made up of dogs that were initially obtained from a shelter and then subsequently returned (Patronek et al., 1996; Salman et al., 1998). Modification of the known risk factors for a dog being relinquished to a shelter could substantially reduce the estimated 8 million dogs handled by shelters annually. Some of the known risk factors for relinquishing a dog are the dog being sexually intact, owner's inaccurate expectations of the animal and behavioral problems (Patronek et al., 1996; Scarlett et al., 1999).

The mission of an animal shelter is to find new homes for abandoned animals. However, in order for this objective to be met, new homes must also be successful ones. Currently, animal shelters rely on the animals to sell themselves to prospective owners but this may not be realistic for an animal that is suddenly in a new and strange environment.

Animal shelters provide information on an animal to the best of their knowledge, however this information is not always accurate or complete. It is commonly agreed upon that temperament is highly heritable and that the selection for specific temperaments has led to distinct temperament differences between breeds (Ledger and Baxter, 1997). However, a dog's temperament is only partially inherited, it is also shaped by interactions with the dam and littermates and is very much affected by early experiences. Temperament in dogs ranges from very timid to extremely bold, from placid to excitable, from submissive to aggressive, from very people oriented to quite aloof and independent. While most dogs do have a basic underlying temperament, it is not uncommon for dogs to display different behaviors in different situations.

The adoption problem animal shelters face is twofold. First, the majority of their dogs are not of one distinct breed but usually a medley of three or more. Thus, it is difficult to identify an animal's breed or even begin to generalize about a possible underlying temperament. Second, previous experiences and upbringing are also unknown. In the majority of cases, prospective owners are left with inaccurate and/or incomplete information about the adoptable dog. By allowing more accurate information to be available on an animal, a better match

may be made with the adopter's lifestyle and their expectations of the animal as a pet (Goodloe and Borchelt, 1998). This can empower the owner to be an educated and responsible pet caregiver thus, allowing the animal to be placed in a home where it will remain.

Dogs are returned or relinquished to the shelter for a variety of reasons. One of the most common reasons is because of unrealistic expectations of the animal by the new owner(s) (Patronek et al., 1996; Scarlett et al., 1999). Overcrowding in the shelter is not because of too many dogs or unwanted dogs but rather people's expectations of the dog as a pet (Miller et al., 1996). Unrealistic expectations may, be in part, due to a lack of knowledge about an individual animal's temperament. There are many breed typical temperament traits but each animal is an individual with variations in behavior due to interactions between genetic variation, social environment and previous experiences (McCune et al., 1995).

A dog's personality, behavior and compatibility with the human household are directly related to satisfaction with and retention of that animal (Neidhart and Boyd, 2002). With this being known, it is surprising that a confounding factor for successful adoptions is that most dogs are chosen based on their appearance rather than function or temperament (Posage et al., 1998). This may be because function and temperament information is not available or in some cases where it is, the information is ignored.

Some shelters currently utilize temperament information to facilitate adoptions, but the practice is not widespread. To date, there have been no

published data on the effect of temperament information on adoption occurrence, time to adoption or adoption satisfaction. Some shelters do not invest in temperament testing because they do not have evidence of their investment being returned i.e. a greater number of adoptions in less time and fewer animals subsequently returned.

Previous research has documented that animal shelters, while attempting to help animals, are nevertheless a stressful environment (Hennessy et al., 2001) – potentially inhibiting animals from displaying their true personalities. While housed in the shelter, dogs are exposed to uncontrollable and unpredictable surroundings, novel and irritating stimuli and lack of social interaction (Hennessy et al., 1997). During a dog's first three days in a shelter their cortisol levels are triple that of household pets (Hennessy et al., 1997) therefore the first few days are important in alleviating the stress response (Hennessy et al., 1998).

The environment in a shelter can cause chronic stress and the result can be a response that becomes maladaptive where illness, anxiety, self-mutilation, aggression, depression and behavioral problems can develop. All of which compromise the individual's welfare (Schilder, 1992). In addition to reduced welfare, chronically stressed dogs require more medical attention, isolation from other animals, and behavior modification. Stressed dogs are less likely to be adopted, if at all, and spend more time housed in the shelter utilizing valuable resources i.e. kennel space, food, medical supplies etc.

Improved animal welfare and a reduced stress environment in the shelter can be achieved through social interaction with humans and other dogs, group housing, noise abatement kennel design and kennel enrichment.

Previous studies have indicated that petting a dog can reduce stress experienced from an electric shock (Lynch and McCarthy, 1967) and dogs in confinement benefit greatly, in terms of stress response and mental health, to human interaction, in particular tactile interaction (Hennessy et al., 1998). Human contact and socialization may be more important than canine contact (Wolfe, 1990) and the withdrawal of such can be especially stressful to dogs accustomed to human contact (Fox, 1986). Currently, there are no guidelines regulating positive physical contact with humans for shelter dogs.

Other studies have indicated that dogs being housed individually have an adverse affect on dogs (Clark et al., 1997; Hubrecht et al., 1992). Dogs housed alone move more, show more abnormal movements and vocalize more when compared to dogs housed with other dogs (Hetts et al., 1992). To my knowledge, there are no physiological data on whether group or pair housing reduces stress response as measured by cortisol levels. Pair and group housing has many other beneficial effects including enrichment for the animals (www3.telus/cac/kennels.net, 2003), fewer behavior problems (Hubrecht, 1993a; Mertens and Unshelm, 1996), quicker adoption rate and lower attrition rates (Mertens and Unshelm, 1996), more time spent sleeping/resting (Hetts et al., 1992) and reduced shelter noise (Mertens and Unshelm, 1996). Despite all of

the documented benefits to pair and group housing there is still a strong prejudice against it in the United States (Mertens and Unshelm, 1996).

By design, kennels have poor acoustical properties and tend to be loud because there are few sound absorbing surfaces. In dog kennels, the main source of noise is dog barking (Sales et al., 1997) yet this factor is often ignored during building design (Hubrecht, 1993). The level of noise recorded in some animal facilities is regularly above 90dB (Milligan et al., 1993; Sales et al., 1997). This level of sound can have severe physiological effects on dog hearing and become another stress variable in an already stressful environment.

Since companion animal welfare is an important topic to researchers and the general public, variables contributing to compromised welfare need to be identified and managed within acceptable limits. The objectives of this study were to 1) examine the effectiveness of temperament information on adoptable adult shelter dogs to improve adoption occurrence, time to adoption and adoption satisfaction; 2) examine the effectiveness of human contact with dogs to lower stress levels; 3) examine the effect that pair housing has on stress level and 4) survey ambient noise levels present in an animal shelter during normal day and night activities.

LITERATURE REVIEW

Dogs are housed in an animal shelter for a variety of reasons. Primarily, they are kept there while waiting to be adopted. The animal shelter is a stressful environment for a dog due to the presence of novel surroundings, irritating stimuli and social isolation. Adopting a dog from this type of environment without information pertaining to individual temperament may result in high attrition rates and poor animal welfare. Dogs that are not adopted, are returned continuously or degrade mentally and physically in the stressful shelter environment are at risk for euthanasia.

Personality

There is some confusion and ambiguity in the present literature regarding the personality and temperament of an individual (human and animal). This is most obvious in the human literature but does expand to other species. For humans, the term personality is more commonly used than temperament while temperament is considered to be just one element of personality (Allport, 1961). Temperament is sometimes considered to be the building block for personality (Allport, 1961), the genetic component. However, development and interaction

with the environment is necessary for the progression from temperament to personality (Berger, 1982).

Researchers tend to agree there are five human personality traits (Berger, 1982; Allport, 1961; Tupes and Cristal, 1992; Digman, 1990); but the names of each trait vary between researcher and personality test. Berger (1982) describes the five dimensions: as physique, activity, sociability, emotionality and cognition. Tupes and Cristal (1992) describe them as surgency (responsiveness to the environment and self-initiated actions, i.e. vocalizations), agreeableness (general pleasantness of an individual's social interactions), conscientiousness, emotional stability and openness (desire, willingness and ability to learn from outside sources). Digman (1990) describes the five as extraversion, neuroticism, conscientiousness, agreeableness and openness, while Gosling and John (1999) have concluded extraversion, neuroticism and agreeableness apply to the greatest number of species (human and nonhuman). However, research on the personality of animals has focused mainly on extraversion (sociability and activity) and neuroticism (anxiety and moodiness).

Nonhuman animal research involving personality and temperament does not always distinguish between the two. This may be because personality is considered a human trait and applying it to animals, anthropomorphic. The literature describing psychological traits of animals most commonly refers to them as something other than personality traits i.e. temperament dimensions (Cattell and Korth, 1973), behavioral traits (Draper, 1995), factors (Hart and Hart, 1985) and temperament traits (Goodloe and Borchelt, 1998). An exception to

this trend is the recent study of canine behavior by Svartberg and Forkman (2002) entitled "Personality traits in the domestic dog". Despite the recent research on the basic temperament and/or personality of the domestic dog there is a need for more data (Goodloe, 1996). The following table outlines previous research on domestic dog temperament traits.

Researcher	Year	Number of traits	Traits
Cattell and Korth	1973	11	Exuberance, aggressive excitation, physical size, emotionality, self-sufficiency, obedient cooperation, competence, timidity, calmness, aloofness and apprehension
Hart and Hart	1985	4	Reactivity, aggression, trainability, investigation
Draper	1995	3	Reactivity, aggression, trainability
Bradshaw et al.	1996	3	Reactivity, aggression and immaturity
Ledger and Baxter	1997	5	Aggression, excitability, timidity, obedience and separation anxiety
Serpell and Hsu	2001	8	Stranger-directed fear/aggression, non-social fear, energy level, owner directed aggression, chasing, trainability, attachment and dog-directed fear/aggression
Svartberg and Forkman	2002	5	Curiosity/fearlessness, playfulness, chase-proneness, sociability and aggression

Using cluster analysis and factor analysis on 56 breeds and 13 behavioral traits, Hart and Hart (1985) concluded there were four factors to canine temperament. 1) Reactivity in dogs was defined as excitability, general activity, snapping at children, excessive barking and demand for attention. 2) Aggression

was territorial defense, watchdog barking, aggression towards other dogs and dominance with owner. 3) Trainability included level of obedience training and ease of housetraining. 4) Investigation was defined as degree of destructiveness and playfulness an individual displayed.

In 1995, Draper determined there were three behavioral traits for dogs and that each trait had an obvious physical indicator. The three behavioral traits also corresponded with three of the five orthogonal human personality traits described by Tupes and Cristal (1992). Reactivity in dogs corresponded with surgency for humans and was related to overall size. Aggression in dogs corresponded with (dis)agreeableness in humans and was related to ear physiology i.e. erect. Trainability in dogs was related to openness in humans and corresponded to height. Draper found that large, strong dogs were less reactive than smaller lighter built dogs, dogs with pointed ears were more aggressive than their counterparts with flop ears and there was a negative relationship between short legs (height) and trainability. Draper however acknowledged that he could not explain the negative relationship between height and trainability and that this might be an artifact of artificial selection by humans.

The traits identified by Draper (1995) were the same as the traits identified by Hart and Hart (1985) minus one trait, investigation. Even though Draper did not identify the trait of investigation in domestic dogs he concluded it could loosely resemble the human trait of conscientiousness.

Bradshaw et al., (1996) found three underlying traits, aggressivity, immaturity and reactivity in the domestic dog. The aggressivity trait involved

territorial defense, dominance over owner watchdog behavior and aggression towards other dogs. Reactivity was associated with excessive barking, excitability and demand for affection while immaturity was mostly associated with playfulness, destructiveness and general activity. It was concluded that males were more aggressive and immature than females, and females were more affectionate, easier to train and more reactive than males.

The temperament test developed and validated by Ledger and Baxter in 1997 yielded five personality traits in dogs when it was used to assess dogs in a shelter environment that were surrendered by their owner. They also concluded that there are two general traits, excitability and timidity, that will influence a dog's behavior in most situations.

Svartberg and Forkman (2002) concluded there was a broad personality dimension in the dog that encompassed curiosity/fearlessness, playfulness, chase-proneness, and sociability and this dimension was a corollary of the shy-boldness axis also found in humans and other animals. This axis is defined as an individual's tendency to approach novel objects and their willingness to take risks. This axis has been identified in octopus (Mather and Andersson, 1993), fish (Wilson et al., 1993), cats (Feaver et al., 1986) and primates (Stevenson-Hinde et al., 1980).

Regardless of the number or name of temperament traits found in the dog by previous researchers, an important consideration is accurately testing for traits in individuals. Accurate identification of individual temperament traits may allow for better husbandry and welfare of domesticated dogs.

Temperament Assessments

Temperament testing is a popular method for assessing personality in dogs. For dogs, temperament testing is different from other nonhuman animal species because dogs live in a variety of environments i.e. households, kennels, shelters, laboratories, in the wild and there are different goals of each temperament test. Temperament tests are used for different purposes such as assessing attack/police dog potential, guide-dog potential, adoption potential, obedience potential, predictors of future behavior problems and personality (future temperament) or are general behavioral assessments. The results of each test are dependent upon the population, test objective and time of the test in the individual's life.

The most popular focus of research for temperament testing is for dogs in the shelter environment (Ledger and Baxter, 1996 and 1997; Rosenthal, 1999; van der Borg et al., 1991; Sternberg, 1998). This environment contains three main classes: puppies, stray adults and surrendered adults. Puppies are more likely to have an aptitude test to predict both future behavior problems and basic inherited traits such as energy level, obedience potential and dominance/submission traits. Whereas adults are assessed for adoption potential, existing behavior problems and potential behavior problems.

Adult shelter dogs are different from adult owned dogs because they do not have a dog-owner relationship and no home territory (van der Borg et al., 1991). Adult stray and surrendered dogs are both being tested for existing

behavior problems, potential behavior problems and personality that has already developed during early interactions with the environment, other dogs and people. However, stray dogs and surrendered dogs are different classes. Stray dogs have an unknown history and may not be trained to respond to a name or if they are trained, the name is also unknown. This makes testing more difficult and observations may not accurately indicate a specific behavior. Surrendered dogs have a limited known behavioral history and handlers can utilize the dog's name. This makes testing somewhat easier but surrendered dogs may be more heavily bonded with their previous owner and not respond to the tester (Sternberg, 1998).

A temperament test was developed and validated for assessing shelter dogs (Ledger and Baxter, 1997). The test was developed with a specific sequence that was integral to the test results. The following list outlines the tasks included in the test developed by Ledger and Baxter (1997):

1) Staring at the dog, entering the kennel and then ignoring the dog
2) Stroking the dog and then ignoring it again
3) A physical inspection of the dog
4) Grooming the dog
5) Leaving the kennel without the dog
6) Showing the dog a leash, saying "walkie" to the dog and putting the collar/leash on the dog
7) Walking the dog on leash
8) Testing with livestock

9) Walking through a gate

10) Leaving the dog in a novel enclosure

11) Recalling the dog

12) Asking the dog to retrieve

13) Playing tug of war with the dog

14) Socialization with an unfamiliar dog

15) Opening an umbrella near the dog

16) Threatening the dog by the tester

17) Offering the dog a tidbit

18) Giving the dog food and then taking it away

Based on a principal components analysis, Ledger and Baxter identified six tasks that were significantly ($P<0.05$) correlated with five commonly defined behavioral traits, excitability, aggression, timidity, obedience, and separation anxiety. Tasks number one and four were correlated with excitability, task number six was correlated with obedience and aggression, task number seven was correlated with timidity, task number 17 was correlated with separation-related problems and timidity and task number 13 was correlated with aggression. Ledger and Baxter realized a test of this length would not be practical in a shelter setting and recommended validating a streamlined test that only included grooming (4), showing the leash, putting the leash on and walking on leash (6 and 7), playing tug of war (12) and offering the dog a tidbit (16).

The temperament test (or variations of) most commonly used in shelters is a test developed by Sue Sternberg (1998). Her basic guideline for temperament

testing is that the person evaluating the dog must conduct the test from the perspective of an inexperienced dog handler. The test should also be done at least two days after the animal arrives in the shelter and surrendered dogs may need more time before they can be tested. In reality, owner surrendered dogs may need anywhere from 3 to 10 days before they are ready for testing but this may not always be practical in a shelter setting (Sternberg, 2002). This allows time for the dog to acclimate and adjust to a broken human-animal bond and most importantly to be capable of forming a new bond with another human. The test needs to be conducted indoors in a quiet place not in the kennel and the tester must be the person to remove the dog from the kennel. Her temperament test evaluates sociability, dominance, play/prey responses, food and possession aggression, sensitivity to stimuli, reaction to strangers and guests, reaction to children and response to cats and is designed to assess the adoption potential of shelter dogs.

An offshoot of Sternberg's temperament test is one designed for the general public's application and assesses suitability as a companion (Rosenthal, 1999) Emphasis is placed on the potential adopter knowing the qualities they are looking for in a companion and then looking for those qualities specifically, which may seem obvious but is not always implemented. Adopters need to examine their lifestyle, budget and living space and most importantly consider the personality they want before size and appearance. Ten tips for assessing adoptable dogs at a shelter are to 1) check out all the dogs, 2) find out how long the dog has been in the shelter, 3) find out who is friendly/sociable, 4) meet with

the dog in an indoor environment, 5) test the dog's touch tolerance and desirability for attention, 6) test the dog's arousal and excitability, 7) test the dog for separation anxiety, 8) walk the dog, 9) test motivation (for training ease) and 10) determine if the dog is child friendly.

Given that approximately one-fifth of all adopted dogs are returned to the shelter (Posage et al., 1996; Salman et al., 1998), some researchers have created and implemented tests designed to predict future or existing behavior problems. However, two concerns with these predictions are that the future environment for the adopted dog is being assumed and potential behavior problems are dependent on how the future owners house, train, discipline, interact with and socialize the dog (van der Borg et al., 1991). The temperament test used by van der Borg et al. (1991) assessed aggression, obedience, fear and separation anxiety in stray and owner surrendered shelter dogs. The test included the following tasks:

1) Friendly approach to the dog
2) Putting a collar on the dog and walking the dog on leash
3) Basic commands
4) Physical handling
5) Play with the handler including tug of war
6) Threatening behavior by the handler
7) Approach of a doll towards the dog
8) Exploration of an unfamiliar test room
9) Exposure to an opening umbrella and the sound of a car horn

10) Riding in a car and being left alone in a car

11) Taking away food bowl while eating

12) Taking away bone while chewing

13) Taking away play object

14) Exposure to the sound of a doorbell

15) Confrontation with a dominant unfamiliar dog

16) Exposure to an unfamiliar jogger

This test was designed to predict problem behavior of adult shelter dogs in order to improve compatibility between new owners and adopted dogs.

It is the goal of any guide dog organization to accurately identify individuals that will make successful guide dogs. Since training a guide dog is labor, money and time expensive and organizations are looking for ways to maximize the success of each dog, the accurate assessment of a dog's temperament is critical. Dietrich (1984) examined test scores and the ability of a temperament test to accurately predict which individuals will become successful guide dogs. He found that efficiency of predictability was increased by 30% when the temperament tasks were in relation to the natural development periods of the dog. Another way to test guide dog potential was examined by Serpell and Hsu (2001). They utilized information gathered from puppy raisers for each individual and found eight "stable and interpretable factors" for assisting in the prediction of future successful guide dogs. These factors were stranger directed fear/aggression, non-social fear, energy level, owner directed aggression, chasing, trainability, attachment and dog directed fear/aggression.

Temperament testing dogs or puppies and its corresponding predictive value is controversial. According to Overall (1994), a test does not necessarily accurately predict adult temperament but may predict potential behavior problems such as, aggression, fear, and separation anxiety. A concern about the use of temperament tests to predict success as a household pet is that the tests are conducted on young puppies. At the age of 7 weeks there is still a lot of time for environmental interactions and the development of personality to affect a dog's temperament; a single test only evaluates at one fixed period in the dog's life. The use of a single temperament test is limited, it may indicate early problems and facilitate the appropriate pairing of certain puppies with humans (Overall, 1994). More reliable results may be better obtained by repeating the assessment with the same test person every four weeks (Overall, 1994).

Behavioral Genetics

The field of behavioral genetics has become an increasingly popular research focus. Behavioral genetics has been studied in most species and is ongoing in the domestic dog due primarily to welfare concerns.

Behavior problems in the dog are not uncommon. The most common behavior problems seen in dogs are aggression, separation anxiety, inappropriate elimination and destructiveness (Overall, 1994). The inheritance of behavioral problems is known to be present in all animals but they are best known in the domestic dog, yet the mode of inheritance is still not known (Beaver, 1981). Behavioral problems can either be inherited or acquired and

sometimes the acquired form is the result of a genetic predisposition. Beaver (1981) identifies some of the most common inherited and acquired behavior problems in the domestic dog.

> Aggression has approximately ten variations. Intermale, dominance and protective types all have strong heritable components. There has been selection for some breeds to maintain and focus their aggression tendencies. In these breeds the tendency for aggression is easily stimulated.
>
> Timidity has two types; it can be inherited or acquired from a sheltered environment (most common).
>
> Fear biting can be inherited in two ways: it can be passed on directly as a familial trait or it can be the result of breeding a dominant aggressive dog to a timid dog. Environmental conditions can also produce a temporary fear biter, this is a dog that is afraid, cornered and cannot escape.
>
> Fear of noise is usually environmental and is a result of trauma. There is an inherited form but its genetic basis is hard to prove.

The heritability of behavioral traits has been studied extensively in the domestic dog (Mackenzie et al., 1985; Reuterwall and Ryman, 1973; Rosberg and Olausson, 1976; Pfleiderer-Hogner, 1979; Bartlett 1976; Goddard and Beilharz, 1986; Falt et al., 1982; Ruefenacht et al., 2002; Stur, 1987; Willis, 1987; Mackenzie et al., 1985). The conclusions vary between researcher, study and behavioral trait investigated. There is a general consensus with some researchers that behavioral traits are highly heritable (Bartlett, 1976; Goddard and Beilharz, 1986; Falt et al., 1982) while others conclude behavioral traits have low heritability (Reuterwall and Ryman, 1973; Rosberg and Olausson, 1976; Pfleiderer-Hogner, 1979; Ruefenacht et al., 2002). Different studies using different methods of evaluating temperament may actually be studying different traits (Mackenzie et al., 1985) and this may be one of the reasons for the inconsistency in reported heritability of behavioral traits.

Data may indicate behavior traits have low heritability because some of the tests are inadvertently testing the environmental influence on the behavior (Willis, 1987). Phenotypic expression of genetic potential is strongly linked to the environment in which the individual develops. Genetic influence does not imply environmental effects cannot alter it (Marks, 1986) but genetics can alter the way an animal responds to an environment.

There has been much discussion about the environment as an influential variable on behavior traits (Bradshaw and Goodwin, 1998; McBride, 1995; McCune et al., 1995). The behavioral characteristics of a breed differ more within a breed than physical characteristics because they are not as closely monitored and controlled by breed standards. This variation in behavior is a result of the complex interaction between genetic variation and social environments experienced by individual dogs (McCune et al., 1995). The developmental periods of socialization in a dog's life (McCune et al., 1995), in addition to previous experiences, training and interaction with its owner (McBride, 1995; Hart and Hart, 1985) are very influential in shaping individual behavior and can substantially modify breed-typical behavior characteristics.

Some researchers believe dogs have behavioral stability from an early age (Pfaffenberger et al., 1976; Goddard and Beilharz, 1986) not unlike their wolf ancestors (Fox 1972). While others believe behavior is influenced and shaped through interaction with the environment. All behavior has a genetic predisposition, which varies in intensity between individuals, and the environment

in which the dog lives and interrelates can encourage or discourage the manifestation of specific behavioral traits (Stur, 1987).

Stress and Cortisol

Stress

Stress can be defined as any circumstance, which disturbs the balance between an organism and its environment; this can include physical or mental activity, irritating stimuli or trauma, hypoxia, toxins or disease (Kissebah, 1974). Stressors are stimuli that an animal perceives to be abnormal for their environment and situation; this stimulus is usually prolonged and/or intense (Stephens, 1980). Stress occurs when an animal's homeostatic, physiological and behavioral responses are a result of its interaction with stressors (Stephens, 1980). The immediate physiological response is activation of the sympathetic nervous system, which causes the release of noradrenaline and adrenaline from the adrenal medulla. If stress persists, the adrenal cortex releases corticosteroids. Stress is usually detected through the monitoring of hormone levels. However, physiological indicators of stress are not adequate alone, behavioral responses must also be evaluated (Vincent and Mitchell, 1996; Schilder, 1992; Vincent and Leahy, 1997).

Many studies have evaluated the physiological responses that occur during stress. Galosy et al. (1979) found that behavioral stress causes increased cardiac performance but does not increase body activity, while mental stress can increase catecholamine levels and cause heart problems (Liang et al., 1979). Vincent and Leahy (1997) found that stress-prone dogs had more variability in

their heart rates than calm, non-stressed dogs. Acute stress causes muscle vasodilation and increased heart rate and blood pressure (Caraffa-Braga et al., 1973; Vincent and Mitchell, 1996). In a study by Granata et al. (1973) it was concluded that emotional stress and an inhibition of jejunal activity are correlated. This relationship is influenced by stress intensity and motility of the animal when the stress occurs.

In acute situations, the stress response itself is adaptive and helps an animal manage a situation. If the stress becomes chronic the response becomes maladaptive. Illness, anxiety, self-mutilation, aggression, depression and reduced reproduction may develop in a chronic stress environment (Schilder, 1992). Traumatic events are classified as acute stressors but can affect an individual for an undetermined length of time.

If an animal is capable or expects to be capable of controlling its environment when stimuli is present its welfare is not compromised (Schilder, 1992). If the animal perceives a threat and is unable to respond or responses continuously fail, chronic stress develops. Signs of chronic stress indicate a dog's inability to cope in that environment; if signs of chronic stress are present, the welfare of that individual in that environment has been compromised.

Some common behavioral responses displayed by dogs while experiencing a stressful situation include yawning, crouched/low posture, trembling, showing the tongue, scratching, bodyshaking, urinating, drinking, avoidance, smelling the ground, walking to and fro, laying down, excessive auto-grooming, paw lifting, feces eating, vocalizations and stereotypies (repetitive

movements) (Beerda et al., 1998; Hetts et al., 1992; Schilder, 1992). However, individual response to stress can vary depending on genetic predispositions, experiences during sensitive periods of development and previous experiences with the stressor (Schilder, 1992). Responses can also change, be reinforced through learning or be alleviated through learning, genetic selection and better handling and husbandry practices (Fraser, 1999).

According to Schilder (1992) there are two ways dogs deal with stress, passively and actively. A passive reaction is associated with a diuretic response i.e. urination. This is probably due to a parasympathetic response. The animal does not attempt to fight or flee the situation but instead outward appearance indicates they are coping when in fact they have a decreased heart rate. An active reaction is the more commonly known response – fight or flight, an activation of the sympathetic nervous system. These individuals experience increased heart rate and increased respirations and salivation; this is considered an anti-diuretic response. Different species have different stressors, respond differently and are affected differently. For cattle the most powerful short-term stressor is novel stimuli and their response to stress depends on their physical and social environment during early stages of development (Stephens, 1980). For sheep, the main stressors are adverse climates and nutrition, they are also acutely aware of novel stimuli (Stephens, 1980). In pigs, social stress (grouping and mixing) is most influential and may cause pale, soft, exudative meat (Stephens, 1980). For horses, management and husbandry practices are the

most common stressors (Stephens, 1980); salivary cortisol level and heart rate increase during stressful situations (Licht, unpublished).

Cortisol

Many steroid hormones are affected by physiological stress. Cortisol is recognized as the major indicator of response to stress (Kirschbaum and Hellhammer, 1989; Bassett et al., 1987) and is used in animal welfare studies to detect poor welfare (Blackshaw and Blackshaw, 1989; Parrot and Mission, 1989; Fell and Shutt, 1986b; Beerda et al., 1996). Cortisol levels alone do not indicate a stressful state but they can be used in conjunction with other observations to provide important information on an animal's stress level (Vincent and Mitchell, 1992b). However, cortisol levels may indicate an emotionally stimulated state when observable behavior does not (Vincent and Mitchell, 1992b).

Cortisol is the main glucocorticoid hormone produced in the adrenal medulla. It is released spontaneously under normal conditions and is also released in response to stress. Stressors can override negative feedback loops and cause both increased frequency and amplitude in cortisol release pulses. Cortisol is highly lipid soluble and has a molecular weight of 362. A circadian rhythm for cortisol has been documented with higher levels in the morning and lower levels in the evening (Kirschbaum and Hellhammer, 1989; Van Heerden and Bertschinger, 1982; Zasshi, 1983). The morning level is more stable while afternoon and evening levels are more influenced by external stimulation (Kirschbaum and Hellhammer, 1989).

In dogs, there are no documented differences in basal levels of cortisol between genders (Reimers et al., 1984 and 1990; Kirschbaum and Hellhammer, 1989) but there is considerable variability across days within individuals (Kirschbaum and Hellhammer, 1989). Basal cortisol levels are influenced by size and age but reproductive status (Reimers et al., 1984 and 1990). Smaller breeds tend to have higher basal cortisol levels than larger breeds and nursing pups have higher levels than older dog (Reimers et al., 1984 and 1990; Hennessy et al., 1997). Stress induced cortisol levels do not follow the same trends. Females have higher cortisol levels than males (Garnier et al., 1990) and juvenile/pups have lower cortisol levels than adults (Hennessy et al., 1998). Males seem to adjust more quickly to stressful situations than females (Garnier et al., 1990).

Salivary cortisol is a better measure of adrenal cortical function and is a better physiological indicator of stress than plasma cortisol (Bassett, et al., 1987; Kirschbaum and Hellhammer, 1989; Cook et al., 1996; Fell et al., 1985; Fell and Shutt, 1986b; Fuchs et al., 1997; Groschl et al., 2000, Parrot and Mission, 1989). Cortisol passively diffuses into saliva via the acinar cells. The time lag for change in plasma cortisol levels to result in salivary level change is less than 5 minutes (Walker et al., 1984; Tunn et al., 1992). Salivary cortisol levels and plasma/serum levels are highly correlated (>0.92) (Beerda et al., 1996; Cook et al., 1996; Groschl et al., 2000; Mallamud, 1992) but are only 4-12% of the levels found in plasma (Beerda et al., 1996; Kirschbaum and Hellhammer, 1989; Parrot et al., 1989; Vincent and Mitchell, 1992a). Salivary cortisol levels are low because they represent the "free" unbound portion of the total cortisol level.

Cortisol in the blood is 90% bound with cortisol binding globulin (CBG) and the amount of CBG in the blood is important when measuring cortisol as an indicator of stress. The remaining 10% is the portion that is available to target tissues; this is considered the biologically active part (Cook et al., 1996; Meyer and Rothuizen, 1993; Kirschbaum and Hellhammer, 1989). During periods of stress CBG becomes saturated and causes a disproportionate increase in free cortisol (Tunn et al., 1992). Under these conditions the total level of cortisol does not necessarily accurately represent the "free", biologically active portion of cortisol (Cook et al., 1997).

Salivary cortisol is a direct reflection of the biologically active portion of the total cortisol level (Cook et al., 1997) and is independent of flow rate or rate of diffusion from the blood (Haeckel, 1990; Beerda et al., 1996; Cook et al., 1997; Kirschbaum and Hellhammer, 1989). The measurement of salivary cortisol has been widely used as a noninvasive way to measure stress in dogs (Beerda et al., 1996; Beerda et al., 1998; Lester et al., 1981), sheep (Fell et al., 1985; Fell and Shutt, 1986b), cattle (Fell and Shutt, 1986a; Fell and Shutt, 1986b), pigs (Parrot et al., 1989; Parrot and Mission, 1989; Cook et al., 1996), squirrel monkeys (Fuchs et al., 1997) and bats (Widmaier and Kunz, 1993). The hormone cortisol is not affected by tube type, glass or plastic, (Behrend et al., 1998) or the use of cotton for saliva collection (Shirtcliff et al., 2000; Haeckel, 1990). Saliva can be collected using the flow method, spit method, suction method and absorption method (Haeckel, 1990).

Noise

Vibrating objects cause sound, which in turn causes a change in air pressure. Sounds vary in duration, frequency of vibration (Hertz) and intensity (perceived as loudness measured in decibels). Noise intensity is measured in a logarithmic scale; 90dB is ten times louder than 80dB. Reverberation time is the amount of time it takes for a sound to dissipate to 60dB. Noise is undesirable sound (Noren, 1987; Key, 2000) and the perception of noise depends on three objective factors, level of noise, source, distance from the source and one subjective factor, sensitivity (Muller, 1987). Therefore, the level at which sound becomes noise is based on individual perception (Gamble, 1982).

A dog's hearing is four times more sensitive to sound intensity than a human's (Key, 2000; Sales et al., 1993). Dogs can hear sounds ranging in frequency from 40Hz up to 50kHz and are most sensitive at 500Hz to 16kHz (Sales et al., 1996; Key, 2000). Dogs can produce a bark over 100dB with a frequency range of 300Hz to 2kHz (Sales et al., 1996; Chapel, 2001). However, the auditory sensitivity of a dog is not completely understood. It is known that a dog's hearing is more acute and they can hear frequencies in the ultrasonic range, which makes them vulnerable to a wider range than humans.

In addition, the inner ear of a dog has not been extensively researched. It is not definitively known if the dog has an inner ear mechanism that protects the inner ear drum during vocalizations. However, if such a mechanism were present it would probably not be successful in protecting an individual when

exposed to continuous barking by conspecifics (Peterson, 1980). The following table outlines human hearing sensitivity.

Sound level in decibels (dB)	Source
140 (painful)	Firearms, air raid siren (threshold for pain)
130	Jackhammer
120	Jet plane take-off
110 (extremely loud)	Rock music
100	Snow mobile, chain saw. Hearing damage if excessive exposure to levels >90dB
80 (very loud)	Alarm clock
70	Busy traffic, vacuum cleaner
60	Normal conversation
50 (moderate)	Moderate rainfall
45	Rustling leaves
30 (faint)	Whisper
15	Threshold of hearing
0 (undetectable to most)	Acute threshold of hearing

Baker, 1998

Some sounds are not within human range but are still audible to animals. Another aspect of noise that has more recently been investigated is ultrasound. Milligan et al. (1993) found that ultrasound was not present in the kennel environment while in contrast, Sales et al. (1993) did detect ultrasonic noise in the kennel environment and concluded ultrasound should be monitored in addition to audible sound (Sales et al., 1988). Behavioral responses to ultrasound have been reported in, but are not limited to, horses, cattle, sheep, swine and poultry (Algers, 1984). In livestock animals, ruminants are the least affected while poultry and pigs are the most sensitive (Muller, 1987).

Shelter Issues

In the United States, shelters and humane societies are the two primary resources where the public can adopt an animal. Animal shelters use kennels to house animals while they wait to be claimed by their present owner or until they are adopted. This stay can last from a few days to a few weeks. The effects of short and long-term confinement are just beginning to be studied and the overall implications on welfare are being investigated. Social and spatial restrictions are a primary focus followed closely by sensory stimulation and noise exposure.

The USDA and Animal Welfare Association (AWA) regulate cage size and specify exercise of kenneled dogs but does not address social requirements, mental stimulation or maximum noise levels. Spatial activity and exercise may not be the most important welfare factors for a dog (Hetts et al., 1992) but rather the mental health of the animal needs to be addressed (Hubrecht, 1993b; Hubrecht, 1995b; King, 2003; Loveridge, 1998). Good psychological well being is a state where the animal is not in distress most of the time, is in good physical health, exhibits a wide range of species typical behaviors and is able to effectively deal with environmental stimuli (Novak and Drewsen, 1989).

A dog's behavior is affected by housing and husbandry conditions, single vs. group housing, kennel size and arrangement and feeding method (Hubrecht, 1993a). Some common behavioral problems dogs acquire while in the shelter include excessive excitability and arousal, excitement and frustration, lunging at other dogs, restraint/control/handling problems, depression, fearfulness/suspicion of strangers, lunging at the front of kennel or gate, elimination problems, and distress over separation (Sternberg, 1998). Based on the behavior displayed in

the shelter, researchers recommend every dog should have social contact with humans and other dogs and should live in enriched surroundings (Sternberg, 1998; Hubrecht, 1994).

Some simple guidelines for good housing are to pair compatible animals together while still providing each dog with its own kennel; have one staff person in charge of housing, training and socializing the animals; attach bowls to the wall and build ceilings and floors with sound-proof material as well as sound-proofing the kennels (www3.telus.net/cac/kennels, 2003). The Humane Society of the United States (HSUS, 1981) agrees with these recommendations and adds cages should be placed back to back to minimize visual contact between animals and quiet background music should be played. This helps to keep the dogs calm and quiet and reduces stress (HSUS, 1981). Many of the problems animals face in the shelter can be alleviated through daily human contact and basic conditioning to the stressful environment (Tuber et al., 1999).

Stress

The most potent stimuli that affect the pituitary-adrenal-cortex are psychological stressors, most notably novel, unpredictable or uncontrollable situations (Mason, 1968). Psychogenic stressors that affect the hypothalamic-pituitary-adrenal (HPA) axis for dogs include exposure to novel or threatening surroundings (Friedman and Ader, 1967), separation from attachment objects (Hennessy, 1997), unpredictability of external events (Muir and Pfister, 1986), and lack of or loss of control over the environment (Hanson et al., 1976). The

most powerful stress inducing stimuli are novel surroundings and separation from social attachments (Hennessy et al., 1997). Some other irritating stimuli for dogs are restraint (Knol, 1989; Muelas et al., 1993; Rothuizen et al., 1993), loud noise (Engeland et al., 1990; Gue et al., 1987), electric shock (Anderson and Tosheff, 1973) and social punishment (Schwizgebel, 1982).

Stress response to aversive stimuli can also be controlled by the ability of the individual to control or predict the situation (Dess et al., 1983). Some interactions with humans might be capable of alleviating the stress response (Hennessy et al., 1997 and 1998) and petting a dog can eliminate stress from an electric shock (Lynch and McCarthy, 1967).

When dogs are housed in an animal shelter they potentially experience the most extreme form of social isolation and novel surroundings possible (Hennessy et al., 1997). In a study by Hennessy et al. (1997and 1998) dogs were found to have increased cortisol levels for the first three days in the shelter, to have an intermediate level on days 4-9 and to plateau around day 9-10. During the first three days in the shelter environment dogs had cortisol levels that were three times that of normal household dogs (Hennessy et al., 1998).

Cortisol levels will rise in most individuals when they are exposed to novel, unpredictable and uncontrollable surroundings and when there is anticipation of negative events (Kirschbaum and Hellhammer, 1999). However, many factors can contribute to a rise in cortisol and other indicators of stress need to be monitored as well. A study by Beerda et al. (1998) found that the only behavior occurring concurrently with increased cortisol was a very low posture. Body

shaking, restlessness, moderate low posture, yawning, and mouth opening was not related to increased cortisol levels. A very low posture may indicate a severe state of acute stress while the other behaviors may only be mild forms of stress.

Socialization

The shelter is an environment that does not allow the animal to be in control. Having a large number of dogs in constant visual, olfactory, and acoustical communication is stressful (Coppinger and Zuccotti, 1999). An animal cannot cope within an environment of which they have no control (Seligman, 1975). Social contact is one aspect that allows for some control (Hubrecht et al., 1992).

In the shelter, socialization with other dogs and humans is essential for psychological well-being. Social isolation or restriction is regarded as a major stressor for a social species like the dog (Wolfe, 1990). The withdrawal of human and/or conspecific contact can be detrimental to mental health particularly to dogs accustomed to such contact (Fox, 1986). In fact, human contact may be even more important than contact with another dog (Wolfe, 1990; Hubrecht, 1993b). Dogs are more active when humans are present and humans are the most consistent and reliable factor influencing the activity of dogs (Hughes et al., 1989; Hughes and Campbell, 1990). Hubrecht (1995b) concluded that social isolation is the most stressful factor in a kennel environment. This is in accordance with Coppinger and Zuccotti's findings that people are an important resource for dogs and that they interact more in the presence of humans.

Many shelters choose to house animals individually to prevent injuries (Mertens and Unshelm, 1996) even though there is ample evidence that group housing is better for the animals' welfare (Hetts et al., 1992; Hubrecht et al., 1992; Hubrecht, 1993a; Hubrecht, 1993b; Loveridge, 1998; Mertens and Unshelm, 1996; Clark et al., 1997). When housed in pairs, dogs slept more, vocalized less and showed less abnormal behavior compared to dogs housed individually (Hetts et al., 1992; Coppinger and Zuccotti, 1999). Dogs housed singly are more inactive and exhibit more repetitive behaviors such as pacing and circling (Hubrecht et al., 1992; Hughes et al., 1989). These dogs also display more passive behavior and non-social repetitive behaviors; this may be an attempt to offset boredom or frustration (Hubrecht et al., 1992). Dogs caged in isolation from contemporaries had an elevated metabolism and increased heat dissipation when compared to dogs housed individually in a group setting (Woods and Besch, 1974). When switched from group to individual housing there is an increase in cortisol concentrations (Beerda et al., 1999b) indicating higher levels of stress. The results of a study by Mertens and Unshelm (1996) found that housing in groups also keeps noise levels down, fills the need for social interaction, prevents some behavior problems from developing, and allows for a closer human-animal bond. Animals that are housed in groups are also more likely to be adopted, are adopted in less time and are returned less often (Mertens and Unshelm, 1996).

Enrichment and Exercise

Enrichment is very important, whether or not a dog is bored or anxious. Enrichment allows the dog to work off extra energy and behave more naturally in a constrained environment (King, 2003). Generally, enriched animals learn to cope better with stressful situations (King, 2003). According to Hubrecht (1993b) dogs are "neophyllic" requiring a diverse and stimulating environment. Kennels need to be complex and more than two-dimensional; toys, beds, chews and social contact need to be available (Hubrecht, 1994). An optimal housing system will allow the dog to choose to play with objects and provide opportunities for socialization with conspecifics as well as humans (Hubrecht, 1995c). In accordance with socialization research, housing animals together is beneficial and adds complexity to a potentially barren environment (www3.telus.net/cac/kennels, 2003).

Enrichment in the kennel has been an area of interest for animal welfare researchers (Coppinger and Zuccotti, 1999; Hubrecht, 1995a and 1995b; Loveridge, 1998). When dogs are housed in kennels their behavior and mental state deteriorates rapidly and after two weeks their chances of being adopted may be ruined (Coppinger and Zuccotti, 1999). In a study by Hubrecht (1995a), puppies that received enrichment in the kennel environment were more receptive to people and quality of life may be improved.

Since guidelines for exercise have been implemented there have been studies on the effect of exercise on caged dogs (Campbell et al., 1988; Clark et al., 1991, Newton, 1972). Clark et al. (1991) found that exercise does not

prevent the development of abnormal behavior and Campbell et al. (1988) identified that exercise has little effect on physical health or cortisol levels. Findings by Newton (1972) and Clark et al (1997) supported these conclusions. Clark et al. (1991) also found that that cage or pen size had little effect on cortisol or physical fitness as long as adequate size cages were used. However, all of these studies utilized purpose bred Beagle dogs of relatively young age (<24 months). Clark et al. (1991) recognized this limitation and concluded that husbandry of dogs should be based on their upbringing and previous exposure and the results of his study may not be accurately generalized to random source dogs.

Adoption and Surrender

Shelters receive unwanted animals on a daily basis and these animals will most likely be put up for adoption. If a dog is not adopted in a timely manner it is at risk for euthanasia, dogs that are adopted but returned are also at risk. Numerous studies have investigated the criteria for adoption (Posage et al., 1998), the reasons for relinquishment, (Miller et al., 1996; New et al., 1999; Scarlett et al., 1999; Patronek et al., 1996) and reasons for retention or attrition (Neidhart and Boyd, 2002).

The public's perception and education is important for animals available for adoption. Wells and Hepper (2000) surveyed the public and found that they prefer dogs that are not barking, are at the front of their cage and are alert. They also prefer dogs in enriched (toys, bed etc.) rather than barren environments.

These human preferences for the shelter environment might facilitate a dog being adopted more quickly. Public support of animal shelters and a more educated community on the responsibilities of pet ownership, including sterilization and provision of a life long home, may help to reduce the number of animals surrendered to the shelter (Fennell, 1999).

A survey by Posage et al. (1998) revealed that animals from the terrier, hound and non-sport breed groups were adopted much more often than other breed types and dogs with gold, gray and white coat colors were adopted more often than dogs of other coat colors. Dogs that had a history of living in an indoor environment were also more likely to be adopted and retained in the home. However, all of the above mentioned characteristics were also associated with a dog of small stature.

In respect to the pet overpopulation problem, most researchers agree that the problem is not too many pets but rather people's expectations of their pet. Of all the pet's euthanatized each year, half of them were previously owned (Miller et al., 1996). There are conflicting data on what type of people are more likely to surrender a pet. Kidd et al. (1992) found that men, first-time pet owners and parents were more likely to surrender a pet where Miller et al. (1996) found that married people were more likely to relinquish their pet than single persons and New et al. (1999) concluded young white females were most likely to relinquish their pet. The discrepancy may be due to change over time or a change in overall pet owning population demographics. In a survey conducted by Scarlett et al. (1999) the top three reasons for surrendering a companion dog included

lack of time for the dog, owner's personal problems and allergies. The dogs most likely to be surrendered to the shelter were female, intact and less than 3 years old (New et al., 1999) or according to another study (Patronek et al., 1996), intact dogs, dogs that were acquired for free and dogs that spent most of the day alone in the yard or in a crate.

Neidhart and Boyd (2002) investigated the reasons for retaining a pet. They concluded that where the pet sleeps and how much time is spent with the pet played a significant role in retention. They also found that satisfaction with a pet is related to the pet's personality, compatibility and behavior. Attrition rates were higher for people who adopted a dog older than one year, adopted the dog for someone else and had an annual income of less than $35,000 (Neidhart and Boyd, 2002).

Adoption and retention rates may be increased while relinquishment and attrition rates are decreased if companion dogs were more compatible with their owner's lifestyle and household. One study has investigated the behavior of adult companion dogs living in a household (Goodloe and Borchelt, 1998). The goal of this study was to identify traits in dogs that would allow better matches between companions and owners. Environmental variables were evaluated for their potential effects on the expression of these identified traits. This information might provide an opportunity to manipulate these variables in order to enhance desirable traits and minimize undesirable ones which could in return, reduce the number of adopted animals returned to the shelter and the number relinquished.

Architectural Design and Noise

The main goals of kennel design are to provide the animals with comfortable housing, choice of environment, sensory stimulation, physical and mental exercise and canine companionship. A good kennel design needs to allow the animals to satisfy their natural curiosity by observing activities outside their enclosure (King, 2003).

According to Loveridge (1998) some general guidelines for a good shelter design include the following: 1) the building should be easy to work in and designed for easy cleaning, 2) there should be individual buildings for different animal populations to avoid the spread of disease, 3) the animal holding areas should have a domestic home-like ambience, avoiding long corridors with rows of animals in cages, cages and bars should also be avoided, 4) there should be ample light and space with all animals having outdoor access, 5) the animals should be provided with environmentally enriched living accommodations and 6) animals should be housed in pairs or groups whenever possible.

Kennels by their very nature and design have poor acoustical properties; hard smooth surfaces do not absorb sound therefore any noise generated tends to reverberate inside the building. The longer the reverberation time the more uncomfortable the sound will be and the more echoing that will occur (Key, 2000). A noisy building with long reverberation times has a detrimental effect on dogs (Key, 2000). High reverberation times (>1s) can add 5-10dB to the sound level in an enclosed area (Sales et al., 1996). Noise increases are mainly related

to human presence in the kennel, feeding times and cleaning procedures (Sales et al., 1996 and 1999; Noren, 1987).

In a report by Chapel (2001) five design principles are explained for reducing noise levels in a facility. Noise can be reduced through, isolation, absorption, dissipation, masking and design of heating, ventilation and cooling (HVAC) systems. In a kennel environment, masking (covering with background noise) would not be effective for covering sporadic barking. Ambient noise levels in a kennel can be as high as 65dB from the HVAC system alone (Carlton and Richards, 2002). One way to reduce noise is to design the building so that the caretaker does not have to walk past all the dogs for daily activities; thereby reducing the amount of negative excitement (Key, 2000; Sales et al., 1996). Sound can also be reduced by substituting sound-absorbing materials for hard masonry or tile surfaces on upper walls and ceilings (Senn and Lewin, 1975). The sound in a facility caused by barking is an important factor often ignored during building design (Hubrecht, 1993b) but if addressed can be managed within acceptable limits. Noise levels can be reduced through the use of wall-mounted acoustic panels (Carlton and Richards, 2002; Key, 2000).

Noise as a Stressor

The auditory sense is considered to be the "sentinel of senses", you can always shut your eyes but you can never shut your ears (Hughes and Jones, 2001). Animals respond to sound even while they are sleeping (Wei, 1969; Clough, 1982; Spreng, 2000) and when noise becomes a stressor it affects the

functioning of every other body system (Wei, 1969; Kirschbaum and Hellhammer, 1999; Engeland et al., 1980; Peterson, 1980). Exposure to high levels (>85dB) of sound can lead to auditory and extra-auditory effects (Spreng, 2000; www3.telus.net/cac/kennels, 2003). Auditory effects include hearing damage while non-auditory consequences include disruption of the endocrine, metabolic, cardiovascular, reproductive, neurological and sleep systems (Wei, 1969). In general, high frequencies are more damaging than low frequencies and stimuli for brief periods (1-60s) can have profound lasting effects (Clough, 1982; Knight, 1967; Baker, 1998). Sporadic sounds can be more damaging than more continuous sounds at moderate levels (Peterson, 1980). Sound does not have to be loud to be irritating and the effects of such a stressor are not transitory (Hughes and Jones, 2001).

Noise is a stressor for dogs (Sales et al., 1996, Kirschbaum and Hellhammer, 1999; Muller, 1987; Babisch, 2003) and it affects physiological functioning (Babisch, 2003; Gamble, 1982). Since the auditory system is always functioning, noise influences the release of hypothalamic hormones (Spreng, 2000; Kirschbaum and Hellhammer, 1999). Plasma cortisol levels were found to increase 215% during periods of acoustic stress and stomach motility was also inhibited (Gue et al., 1987). The best studied non-auditory physiological effect of noise induced stress is the audiogenic seizure. Species susceptible to this condition include mice, rats, rabbits, chickens, dogs, goats some cats and in rare cases humans (Clough, 1982). An audiogenic seizure is triggered by sound stimuli and is characterized by sound-precipitated convulsions. During a seizure

the animal may crouch, shiver, and indulge in substitute behavior (preening and washing), next violent, wild, uncontrolled running and convulsions involving tonic and clonic episodes occur (Gamble, 1982).

Even though studies show that noise has adverse effects on the behavior and physiology of animals the acoustics of an environment are rarely monitored and fluctuate greatly (Milligan et al., 1993; Sales et al., 1999). In contrast, lighting, temperature, humidity, food and water are regulated within narrow limits. In dog kennels, barking is the main source of noise (Milligan et al., 1993; Sales et al., 1996; Sales et al., 1997). The level of noise recorded in some dog kennels is regularly above 90dB (Milligan et al., 1993; Ottewill, 1968; Peterson, 1980; Sales et al., 1997; Senn and Lewin, 1975; Sales et al., 1993; Newton, 1978). This level of sound can have severe physiological effects on both human and dog hearing.

In view of the fact that large populations of dogs are kept in kennels there is a need for guidelines on acceptable noise levels that will ensure better welfare and overall better health (Sales et al., 1993, 1996, 1997, 1999; Milligan et al., 1993; Key, 2000; www3.telus.net/cac/kennels, 2003; Anthony, 1963; Newton, 1978; Algers et al., 1978). A desirable level for background noise in a shelter is 55-60dB and should not exceed 85dB (Anthony, 1963; Sales et al., 1999). According to Algers and Ekesbo (1977), the same norms for human houses should be used for animal housing (45dB).

The first purpose of this study was to determine if the availability of temperament information on individual adult shelter dogs to potential adopters

could improve the adoption process in terms of adoption occurrence, time to adoption and adoption satisfaction. The second purpose of the study was to determine if 1) implementing a one-time human contact session shortly after intake to the shelter and 2) if housing dogs together in compatible pairs could reduce stress levels of adult shelter dogs.

MATERIALS AND METHODS

All studies were conducted at the Weld County Humane Society (WCHS) in Evans, Colorado. This Humane Society serves 3 municipalities and 15 townships and receives approximately 5500 animals each year. During the study period, animal control officers, police officers and the general public brought dogs to the shelter. All dogs that participated in the study were juveniles or adults, as verified by the absence of deciduous puppy teeth; healthy; non-aggressive and potential adoption candidates. Any dog perceived to be potentially dangerous was not eligible to participate in the study.

The objectives of this study were to 1) examine the effectiveness of temperament information of adoptable adult shelter dogs on adoption occurrence, time to adoption and adoption satisfaction 2) examine the effectiveness of a human contact session via a temperament assessment to lower stress levels 3) examine the effect housing two dogs together has on stress level and 4) to survey ambient noise levels in each dog holding area over a period of 84 consecutive hours.

Experiment 1 - Adoption Occurrence, Time to Adoption and Adoption Satisfaction

This segment of the study examined the use of information derived from a temperament assessment to improve the adoption process. Adoption occurrence was defined by adopted (yes/no), time to adoption was the total number of days from when a dog was made available to the public until it was adopted, adoption satisfaction was based on results from a 6-week follow-up adoption interview that determined if the dog was still present in the household and if the new owners were satisfied with the dog as a pet. The dogs used in this study were stray, juveniles or adults, healthy and non-aggressive. Dogs relinquished by their owner were not eligible to participate. Any dog deemed aggressive or dangerous was removed from the study and any dogs that had previously participated in the study were not eligible to participate a second time. Dogs could be potentially available to participate in the study multiple times if they were brought to the shelter as a stray more than once during the study period.

Upon arrival at the shelter, dogs were placed in an available kennel space by WCHS staff according to WCHS facility procedures. Each dog was assessed for eligibility after it had been officially admitted to the shelter. The daily number of dogs for each group was determined by 1) the number of dogs available and eligible to participate in the study on that day, 2) the respective number of dogs currently available for adoption in each study group and 3) available resources on that day. Dogs were randomly assigned to each group with respect to required group numbers using random number selection from a hat. An attempt

was made to maintain a balance in the number of available dogs in each group on the adoption floor.

If there were small dogs and large dogs eligible to participate on the same day they were first separated by size (small or large) and then randomly assigned to each study group. A dog was classified as small based on which kennel the dog was housed in by WCHS staff, i.e. a run or a cage. Dogs that could comfortable stand up, turn around and lie down in a small cage (22"h x 28"w x 28"l) were housed in a cage in the small stray dog room. Dogs that could not were housed in a run in the large stray dog room.

All dogs (n=130) were assigned study identification numbers, collars and ID tags. Breed type, as classified by AKC classification (Appendix 1), approximate age, sex and height were recorded (Table 3.1). Treatment dogs participated in a temperament assessment on day 2 (Complete description - Appendix 2). The tasks included in the temperament assessment were:

Task 1: Approach – stand neutrally and look at
Task 2: Stand outside and encourage to come to front gate
Task 3: Bend down and talk to
Task 4: Move fingers to another area of kennel
Task 5: Enter kennel – reaction to person (licking behavior was noted)
Task 6: Placement of collar – resistance
Task 7: Leaving kennel with the dog
Task 8: Walking to enclosure
Task 9: Free play
Task 10: Behavior when offered treats
Task 11: Back stroking – stroke slow and deep from withers to base of tail
Task 12: Head pat – lightly and rapidly 3 times – no talking
Task 13: Hands-on all over (pinch toes, hold tail)
Task 14: Play (toys, chase, ball)
Task 15: Stomp over to and yell
Task 16: Basic Commands (sit, lay down, paw, come, down-stay)
Task 17: Socialization w/unfamiliar dog
Task 18: Walk to test room

Table 3.1
Demographics of animals used in Experiment 1 and Experiment 2

Characteristics	Number
Treatment	68
Control	62
Male	76
Female	54
Age	
< 1 year	24
1-3 years	82
> 3 years	24
Height	
< 18 inches	43
> 18 inches	87
Breed Type	
Sport	35
Nonsport	15
Work	23
Herd	38
Hound	5
Toy	10
Terrier	4

Task 19: Exploration of room (Curious)
Task 20: Left alone in room (Anxious)
Task 21: Sit on floor (30 – 60 seconds)
Task 22: Play in room
Task 23: Roll dog over
Task 24: Safe Hug
Task 25: Reaction to "HEY!!"
Task 26: Reaction to novel objects (cars, umbrella, chain)
Task 27: Reaction to novel sounds (horns, chain)
Task 28: Walk through cat room - reaction to cats
Task 29: Put back in kennel
Task 30: Position in kennel 5 minutes later

This temperament test was a variation of Ledger and Baxter (1997). Ledger and Baxter's livestock task and food arrival/removal task were not included. However, additional tasks designed to assess reactivity (tasks 11,12, 15,23, 24, 25, 26 and 27) and separation behavior (tasks 9, 19, 20 and 21) were added. Saliva collection was not a temperament test task but observations made during this procedure were noted.

At the end of the assessment the tester placed each dog, based on general reactions to the above tasks, in the following categories. In the follow-up interview, owners were asked where they would place their dog in the following eight categories:

1) Confident	Intermediate	Timid
2) Calm	Intermediate	Frantic, jittery, hyper
3) People-oriented	Intermediate	Environment-oriented
4) Secure	Intermediate	Insecure
5) Independent	Intermediate	Co-dependent
6) Unflappable	Intermediate	Reactive
7) Gentle	Intermediate	Rough
8) Playful	Intermediate	Non-playful

For statistical analyses, the level of each personality trait was numerically determined. Each task had 3-6 possible responses with each response weighted

in respect to the personality trait being measured. The level for each personality trait was calculated using the response of specific tasks (Table 3.2) that were deemed pertinent to the trait being measured.

Control dogs were issued a Weld County Humane Society (WCHS) cage card that included their name, approximate age, approximate breed(s), sex, ID number and any obvious temperament traits as assessed by the WCHS staff i.e. very playful, good with kids, housetrained (Appendix 3, Figure 1). Information derived from the treatment group's temperament assessments was also made available and included levels for playfulness, obedience, aggression, separation anxiety and reactivity as well as any other notable temperament traits i.e. walks well on leash, lots of energy, needs time to warm-up (Appendix 3, Figure 2). Approximate breed information was not provided to the public for treatment dogs. Treatment dogs were classified as "All-American dogs" in an attempt to compel potential adopters to look at temperament information available on the individual dog instead of relying on preconceived breed typical behaviors and/or typecasts. The term "All-American" was explained verbally and flyers posting its use were displayed throughout the facility (Appendix 3, Figure 3).

When a study dog was adopted, the new owner was asked to read a recruitment sheet (Appendix 3, Figure 4) and asked if they would be willing to participate in the study. They would then answer questions on a preadoption and adoption questionnaire (Appendix 3, Figures 5 and 6); for logistical reasons the pre-adoption and adoption questionnaires were completed at the same time.

Table 3.2
Temperament assessment tasks used in the numerical determination of personality trait level

Personality Trait	Task Number
Confident	1a, 2a, 2b, 5, 9, 11a, 11b, 11c, 13a, 13b, 15, 17c, 17d, 23a, 23b
Calm	1a, 2a, 3a, 5, 6, 7, 8, 10, 11a, 12a, 13c, 18, 20, 23a, 23b, 30
Sociable	1b, 2b, 3b, 4, 5, 11a, 11b, 11c, 12a, 12b, 12c, 13c, 14a, 14b, 17a, 17b, 17c, 17d, 21a, 21b, 22a, 22b, 24a, 24b
Fearful	2a, 3a, 5, 7, 8, 9, 11a, 12a, 13b, 15a, 15b, 17a, 17b, 17c, 17d, 18, 19, 20, 25, 26a, 27a, 29
Independent	9, 11b, 11c, 12b, 12c, 14a, 14b, 20, 21a, 21b, 29
Reactive	8, 11a, 12a, 13a, 13b, 13c, 15a, 15b, 18, 25, 26a, 27a, 28
Gentle	5, 6, 8, 10, 14a, 14b, 17a, 17b, 17c, 17d, 18
Playful	5, 14a, 14b, 17a, 22a, 22b

Each new owner was also asked to sign a consent form (Appendix 3, Figure 7) and further agree to participate in a telephone follow-up interview (Appendix 3, Figure 8) six-weeks later. The adoption follow-up interview was designed to determine satisfaction of the adopted dog with the new owner and household. Retention of the dog and contentment with the dog as a pet were the primary focus of the follow-up questions. New owners were contacted approximately six-weeks following adoption; the response rate was less than 50%. Due to the low response rate from the follow-up interviews there were insufficient data to support valid statistical analyses.

Information regarding the study was posted throughout the facility in an attempt to inform the public of the possibility they might be asked to participate (Appendix 3, Figure 9). Flyers were also posted explaining what the temperament assessment was and its purpose (Appendix 3, Figures 10).

Statistical Analyses

The kennel data were analyzed to assess adoption occurrence. The CatMod procedure (SAS, 2002) was used to analyze whether a dog had been adopted (yes/no). The full model included group (treatment or control), sex and breed type as fixed categorical variables and age, height and cortisol level (day 3) as continuous variables. A backward elimination procedure was used to identify the best fitting model and subsequently eliminated age, height and breed type, the elimination criterion was a p-value greater than 0.20. The final model

for adoption occurrence included the fixed effects of group, sex of the dog and cortisol level.

The time to adoption data set was analyzed with survival analysis techniques and the LifeReg procedure (SAS, 2002). The number of days was log transformed and dogs that were not adopted were right censored. The full model included group (treatment or control), sex and breed type as fixed categorical effects and age and height as continuous variables. Using a backward elimination procedure and a p-value criterion of greater than 0.20, to find the best fit model, age and height were removed. The final model for time to adoption included the fixed effects of group, sex of the dog and breed type.

The adoption occurrence data subset from the treatment dogs was also analyzed to determine if personality type had an influence on adoption occurrence. The CatMod procedure (SAS, 2002) was used to analyze adoption occurrence between personality traits (sociability, reactivity, gentleness, playfulness, calmness, confidence, independence and fearfulness). Preliminary analyses were conducted to determine each personality trait's individual influence on whether a dog was adopted. A separate model was utilized for each personality trait; each model included the respective personality trait and sex as fixed categorical effects and age and height as continuous variables. Based on results from the preliminary analyses, the personality traits calmness and gentleness were determined to be approaching significance ($p < 0.10$) and these two personality traits were then analyzed together in a model that included sex as a categorical variable and age and height as continuous variables. Using a

backward elimination procedure to find the best fit model the variable age was removed ($p>0.20$). The final model for adoption occurrence included level of calmness, level of gentleness, sex of the dog and height.

Experiment 2 – Human Contact and Stress Response

The objective of this segment was to determine if a human contact session conducted shortly after arrival to the shelter could be used as a tool to decrease stress response as experienced by shelter dogs. The same animals and groups (treatment and control) were used as in Experiment 1 - adoption occurrence, time to adoption and adoption satisfaction (Table 3.1). The temperament assessment conducted on day 2 in Experiment 1 was used as the human contact session in this experiment. Each session lasted an average of 45 minutes and was conducted by the same human evaluator for all dogs. The sessions varied in length because of individual animal variation in receptiveness, fear, socialization and playfulness. The session included playing with the dog, walking on leash, grooming the dog and vocal and tactile contact.

Stress response was measured using salivary cortisol levels. Saliva samples were obtained from control dogs on days 2, 3, 4 and 9. For treatment dogs, saliva samples were obtained on day 2 immediately prior to the contact session (2a), $\geq$2 hours after the contact session on day 2 (2b) and on days 3, 4 and 9.

Baseline Dogs

Since there were no true "unstressed" dogs available in the shelter to provide an estimate of resting or basal cortisol levels and no standard to assess the magnitude of stress response of the shelter dogs, the shelter dogs were compared both to each other (treatment – human contact session and control – no human contact session) and to dogs maintained as household pets (baseline). Saliva samples were collected from normal household dogs (n=39) during normal daily activities (resting at home or walking in the park) (Table 3.3). Each dog's sex, age, breed type, source (shelter, breeder or other) and owner's perception of stress level was recorded.

Sample Collection and Assays

Saliva samples were collected using a cotton bud with a string attached to the bud. The bud was sprinkled with citric acid and then placed in the dog's mouth for up to 60 seconds. The wad was removed and placed in a 10cc syringe. The saliva was removed from the wad by plunging the contents of the syringe into a 3cc plastic micro-centrifuge tube. Samples were stored at -20°C until time of assay.

Saliva samples were thawed at room temperature (~25°C) and analyzed using an enzyme immunoassay ("Active™ Cortisol EIA", Diagnostic Systems Laboratories, Webster, Texas). The assay was manufactured for human saliva and was validated in our lab for canine use. The modifications to the assay included extraction of the sample with dichloromethane and reconstitution with a neutral (7.2pH) buffer solution to a 4x concentration of the original sample. The

Table 3.3
Demographics of baseline animals used in Experiment 2

Characteristics	Number
Male	18
Female	21
Age	
< 1 year	5
1-3 years	14
> 3 years	20
Breed Type	
Sport	17
Non-sport	3
Work	5
Herd	8
Hound	4
Toy	2
Terrier	0
Source	
Shelter	17
Breeder	17
Other (friend, found, etc.)	5
Stressed as indicated by owner	
Yes	3
No	36

modified assay sensitivity was 0.011ug/dl calculated by the interpolation of the mean minus two standard deviations of nine replicates of the 0µg/dl Cortisol Standard. The intra-assay precision was determined from the mean of 8 replicates and the coefficient of variation was 4.8%. The inter-assay precision was determined from the mean average duplicates for five separate runs and the coefficient of variation was 1.2%. To determine recovery percentage, a saliva sample containing a known level of endogenous cortisol was spiked separately with three known amounts of cortisol and assayed; recovery was 93.3%. Linearity was determined by diluting a saliva sample of known cortisol level at a dilution factor of 1:2, 1:4, 1:8 and 1:16 (Appendix 1, Figure 11).

Statistical Analysis

The salivary cortisol data set was analyzed using mixed model procedures with repeated measures (SAS, 2002). The data were log transformed for analyses. The data were analyzed separately by day (2, 3, 4, 9) between both groups. Each model included the fixed categorical effects of group (treatment or control), sex and breed type and age as a continuous variable. Using a backward elimination procedure age and breed type were subsequently removed, p-value criterion of greater than 0.20. Animal within breed type was treated as a random effect and the Kenward-Roger method was used to calculate denominator degrees of freedom. The final models for stress response and human contact analyzed separately by day included the fixed effects of group, sex of the dog, breed type and age.

The shelter (treatment and control) cortisol data set was compared to the baseline (normal household dogs) cortisol data. The data were analyzed using mixed model procedures (SAS, 2002). The data were log transformed for analyses. Data from each day, days 2 (treatment – 2b and control – 2), 3, 4 and 9, for the shelter animals were compared separately to the cortisol level of the baseline animals. The full model for each day included the fixed categorical effects of group (treatment, control or baseline), sex and breed type and age as a continuous variable. A backward elimination procedure was used to identify the best fitting model and based on a p-value criterion of greater than 0.20, breed type was subsequently eliminated. Animal within breed type was treated as a random effect and the Kenward-Roger method was used to calculate denominator degrees of freedom. The final models for stress response in the shelter compared to normal household dogs analyzed by day included the fixed effects of group and sex, and age.

The cortisol data from the treatment group on day 9 were analyzed using mixed model procedures (SAS, 2002) to determine the effect by personality type. Previous research indicates high variation in cortisol levels between individuals on days 1-3 and initial stress response in the shelter begins to subside by day 9 (Hennessey et al., 1997). The data were log transformed for analyses. The data were analyzed by personality trait (sociability, reactivity, playfulness, calmness, confidence, independence and fearfulness) using levels numerically determined from the temperament assessment in Experiment 1. The full model included the fixed categorical effects of each personality trait level, sex and breed type and

age as a continuous variable. A backward elimination procedure was used to identify the best fitting model and subsequently eliminated ($p > 0.20$) the personality traits playfulness, calmness, confidence, independence and fearfulness and breed type. Animal within breed type was treated as a random effect and the Kenward-Roger method was used to calculate denominator degrees of freedom. The final model for the effect of personality type on stress response included the fixed effects of sociability level, reactivity level, sex of the dog and age.

Experiment 3 - Stress Response and Housing Arrangement

In this experiment, the stress response of adult dogs when housed in a kennel alone or with a conspecific was investigated. Dogs were housed based according to WCHS procedures, individually or with a conspecific. The criteria for potentially housing two dogs together included overcrowding in the remainder of the facility, arriving at the shelter together and/or enrichment. At the shelter, dogs were preferentially housed individually and the majority of the dogs housed together were due to overcrowding problems. The WCHS staff made an attempt to only pair dogs that were either same sex or altered sex(es) and to pair dogs that were appeared to be compatible.

Dogs were randomly chosen to participate based on their housing arrangement. Housing arrangement was dictated by WCHS staff and facility procedures and was not influenced by the present experiment. This experiment did not include assignment of housing arrangement but simply the collection of

saliva samples from dogs that were already arranged, single or double, in the facility.

In the large adoption area, adult dogs were assessed for eligibility based on housing arrangement, single or double, and length of time in the shelter, $\geq$ 9 days. Any dog that appeared to be dangerous was not allowed to participate in the study. Saliva samples were collected on all eligible dogs. The dog's approximate age, height, sex, breed type based on AKC breed classification (Appendix 1), source (stray or surrender) and arrival date were recorded (Table 3.4).

Sample Collection and Assays

Saliva collection, storage and assay analysis were the same as conducted in Experiment 2.

Statistical Analyses

The housing data set was analyzed using mixed model procedures (SAS, 2002). The data appeared to be non-normal based on results from Shapiro-Wilk W test and normal plots (SAS, 2002) and could not be normalized by transformation (log, square, cube, arcsine, reciprocal or square-root). Therefore a Proc Rank (SAS, 2002) procedure was utilized to develop a new data set of ranked observations.

This new data set was then analyzed using mixed model procedures (SAS, 2002). The full model included the fixed categorical effects of group

Table 3.4
Demographics of animals used in Experiment 3

Characteristics	Number
Single occupancy	27
Double occupancy	27
Male	34
Female	21
Age	
< 1 year	4
1-3 years	45
> 3 years	5
Height	
< 18 inches	11
> 18 inches	43
Breed type	
Sport	6
Non-sport	4
Work	12
Herd	28
Hound	3
Terrier	1
Owner-relinquished	7
Stray	47
Number of days in the shelter	
9-14 days	22
15-21 days	11
> 21 days	21

(double or single), sex, breed type, and source (stray or surrendered) and age and number of days in the shelter as continuous variables. Animal within breed type was treated as a random effect and the Kenward-Roger method was used to calculate denominator degrees of freedom. A backward elimination procedure was used to identify the best fitting model, subsequently age and number of days were eliminated based on a p-value criterion of greater than 0.20. The final model for housing arrangement and its effect on stress response included the fixed effects of group, sex of the dog, breed type and source.

Survey of Ambient Noise

Due to the extreme levels of noise present during the study, sound levels were measured at the shelter. The facility was built in 1999 with five main areas for holding dogs indoors and two main areas for holding cats. Sound measurements were recorded in all indoor dog-holding areas and included the large adoptable area, large stray room, small adoptable room, small stray room and front intake room (Appendix 3, Figure 12). Measurements were recorded using a noise dosimeter (Q-200, Quest Technologies, Oconomowoc, WI) continuously for 84 hours over two weekdays and both weekend days. Noise dosimeters were placed in each room mounted to the wall. The average number of animals, number of kennels and square footage of each holding area are shown in Table 3.5.

The large adoptable and large stray areas are constructed of epoxy-painted cinder block walls and seamless floors on a concrete slab. The dog runs

Table 3.5
Average number of animals, number of kennels and square footage of indoor dog holding areas during 84-hour noise observation period

Holding area	Number of animals	Number of kennels	Area
Large adoptable	34.25 dogs	26 runs	880ft^2
Large stray	15 dogs	15 runs	485ft^2
Small adoptable	9.8 dogs	28 cages	285ft^2
Small stray	9 dogs	17 cages	258ft^2
Front intake	4 dogs	4 runs	240ft^2
	9.75 cats	4 cages	

in the large adoptable and the large stray areas are separated by cement partitions (82") and have chain link doors, both of these areas have an exposed rafter ceiling ($\geq$ 20"). Noise dosimeters were mounted on the wall in these rooms at a height of 12 feet.

The large adoptable area is a smaller area within a larger area enclosed by a cement perimeter wall (82"). The larger room is connected by two hallways, eight doors to other areas (including large stray and small adoptable) and one exterior door. This area contains 26 runs with plexi-glass view windows on the end of each run. The dog kennels line all four-perimeter walls. There is an employee work area (food preparation, washing dishes etc.) in the middle of the room. The large stray area is a separate room adjacent to the large adoptable area. This area has two doors and contains 15 kennels. The dog kennels line the south and east walls.

The small adoptable, small stray and front intake areas are all separate rooms with a suspended non-acoustic tile ceiling (8') and plasterboard walls. Noise dosimeters were mounted on the wall in these rooms at approximately 7 feet.

The small adoptable and small stray areas each have one door, a concrete slab floor and contain metal cages. The cages in the small adoptable area face the interior of the room and the exterior plexi-glass windows; there is an employee work area in the middle of the room. The cages in the small stray area line the east wall and are also placed down the middle of the room. The front intake area contains cages and runs separated by sheet metal (60") and a

linoleum floor. All kennels and cages are on the south wall. The room also contains a refrigerator and a counter with sink and cabinets.

Statistical Analyses

Noise measurements reported were the max levels with slow response and "A" weighting unless otherwise indicated. The noise data were analyzed using a frequency procedure (SAS, 2002) to determine the frequency of time the sound level was above and below each threshold level over the 84-hour observational period. The threshold levels examined were 70, 80, 90 and 100dBA; each dog holding area (large adoptable, large stray, small adoptable, small stray and front intake) was analyzed separately. The data were also analyzed using the Genmod procedure (SAS, 2002) to determine if there were any significant differences between the five dog holding areas at each threshold level (70, 80, 90 and 100dBA). Each area was treated as a fixed categorical effect and as a repeated subject. The model was fit with a binary distribution and an auto-regressive covariance structure.

RESULTS

Experiment 1 – Adoption occurrence, time to adoption and adoption satisfaction

The objective of this experiment was to examine the effectiveness of providing temperament information on adoptable shelter dogs to increase adoption occurrence and decrease time to adoption.

There was a significant difference in adoption numbers between the two groups (Table 4.1). Treatment animals were more likely to be adopted (P=0.036) than control animals. Eighty-eight dogs were made available for adoption (48 treatment and 40 control) and 52 were adopted. Thirty-three of the 52 dogs adopted were from the treatment group (63%) and 19 were from the control group (37%). Sex also had a significant effect on whether an animal was adopted. Females were more likely to be adopted than males (P=0.041). Fifty-four percent of the dogs adopted were females and 46% were male. There was no effect from cortisol level.

There was a statistically significant difference between the treatment and control groups and males and females for number of days to adoption (Table 4.2). There was not an effect from breed type. The average time to adoption for the treatment dogs was 5.64 days and 7.05 days for the control dogs. Male dogs

Table 4.1
Effect of group[a], sex[b] and salivary cortisol level on adoption occurrence (n=88)

Source	df	Chi-Square	P
Group	1	4.39	0.036
Sex	1	4.18	0.041
Cortisol level	1	1.05	0.31

[a] temperament information, no temperament information

[b] male and female

Table 4.2
Effect of group[a], sex[b] and breed type[c] on time to adoption (n=88)

Source	df	Wald Chi-Square	P
Group	1	4.57	0.033
Sex	1	6.12	0.013
Breed type	3	4.94	0.18

* unadopted dogs were right censored

[a] temperament information, no temperament information

[b] male, female

[c] classified by American Kennel Club

were adopted in an average of 4.38 days while female dogs were adopted in 7.68 days. Dogs (treatment and control) that were adopted did so in an average of 6.80 days. Dogs that left the shelter because they were not adopted were removed after an average of 18.14 days.

Number of adoptions and its relationship with personality traits were also analyzed. From preliminary statistical analyses, reactivity, playfulness, independence, fear, sociability and confidence were not found to have an effect on adoption numbers ($P>0.10$). There was however a tendency for gentleness and calmness to affect adoption rate (Table 4.3). In this data subset, sex was not influential but height did have an influence (Table 4.3). Females were slightly more likely to be adopted than males and shorter dogs were more likely to be adopted than taller ones ($P=0.016$).

Experiment 2 - Stress Response and Human

The objective of this experiment was to examine the effect of a human contact session with adult shelter dogs shortly after arrival to the shelter on stress response during the first nine days.

The level of unbound salivary cortisol determined a stress response level for each animal. The data were analyzed separately by day (2, 3, 4, 9) for both shelter groups (treatment and control) (Table 4.4). Group had an effect ($P=0.014$) on day 3 cortisol levels only. A group effect was not present on any other day (2, 4 or 9) (Table 4.4). There were no significant effects from age or breed type on any day measured (2, 3, 4, or 9). Sex had a tendency to be

Table 4.3
Effect of personality type, sex[c], age and height on adoption occurrence (n=48)

Source	df	Chi-Square	P
Gentleness[a]	3	6.43	0.092
Calmness[b]	2	4.83	0.089
Sex	1	2.48	0.12
Height	1	5.85	0.016

[a] very high , high, moderate, low
[b] moderate, high, very high
[c] male, female

Table 4.4
Effect of group[a], sex[b], age and breed type[c] on stress response (salivary cortisol) analyzed separately by day (n)

		Day 2 (92)		Day 3 (73)		Day 4 (66)		Day 5 (51)	
Source	df	F-value	P	F-value	P	F-value	P	F-value	P
Group	1	0.61	0.44	6.31	0.014	0.48	0.49	0.37	0.55
Sex	1	1.90	0.17	2.79	0.099	0.00	0.98	0.02	0.88
Age	1	0.00	0.99	0.16	0.69	0.33	0.57	0.09	0.77
Breed type	2	0.48	0.70	0.48	0.62	0.39	0.68	0.00	0.99

[a] human contact, no human contact
[b] male, female
[c] classified by American Kennel Club

influential on day 3 cortisol level (P=0.099) but not on days 2, 4 or 9 (p>0.10). Treatment animals had a much lower cortisol level than control animals on day 3 and males were lower than females on days 2 and 3 (Figure 4.1).

The baseline, control and treatment cortisol levels were analyzed together to determine if there was a difference between groups (Table 4.5). On days 2, 4 and 9 the baseline animals were very different (P<0.05) from both the control and treatment animals but the treatment and control animals were not different from each other (P>0.10). On day 3, all groups were different from each other (P=0.001). Age and sex did not significantly affect cortisol level on any day measured. The least squares mean was lower in the baseline animals on all days compared to the shelter animals (Figure 4.2). The variance from day 2 to day 9 in the treatment animals decreased consistently but this trend was not seen in the control animals. The variance on all days in the treatment and control groups was higher than the variance for the baseline animals (Table 4.6).

Cortisol levels from the treatment animals were analyzed for the effect by personality trait level on stress response. Day 9 levels were utilized because this day was considered to be the most stable for all animals. Sociability level, reactivity level, sex and age all significantly affected cortisol level (Table 4.7). There were positive correlations between cortisol level and sociability level, and between cortisol level and age. As sociability level increased cortisol level also increased (Figure 4.3). Reactivity level had an overall negative correlation with cortisol level and females had higher cortisol levels than males. As reactivity level

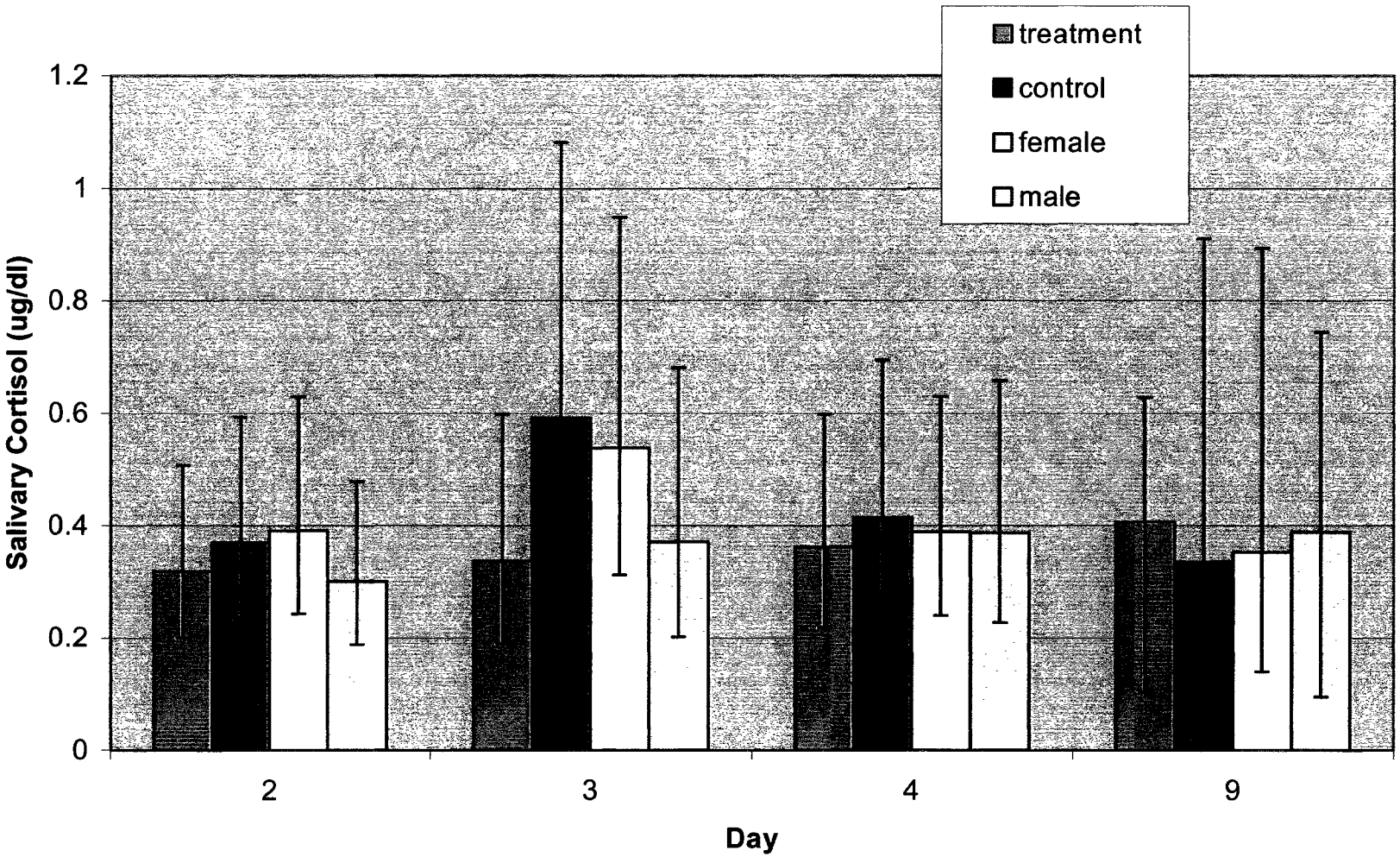
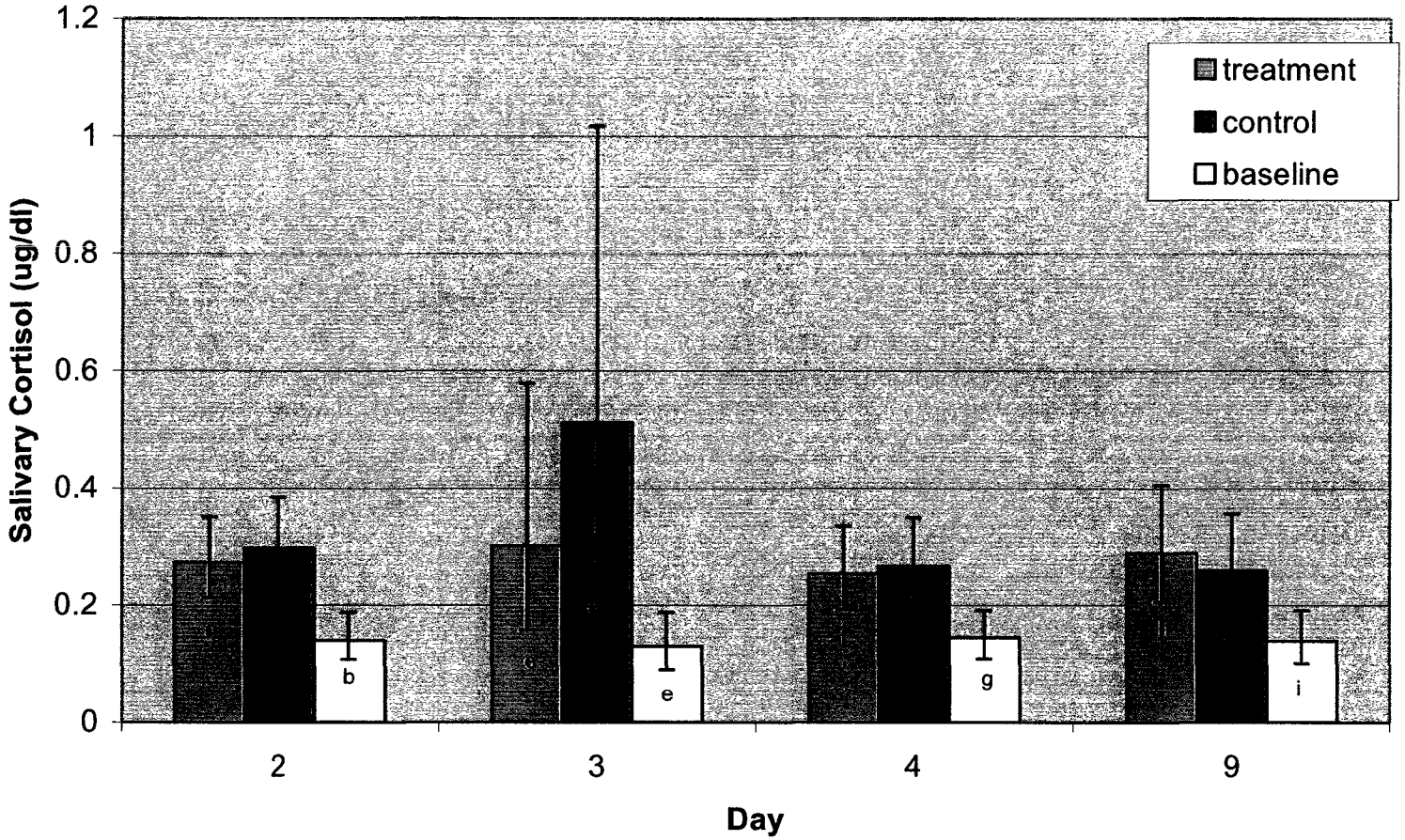


Figure 4.1
LS means (95% CI) for stress response (salivary cortisol) of treatment and control dogs and male and female dogs

Table 4.5
Effect of group[a], sex[b], and age on stress response (salivary cortisol) analyzed separately by day (n)

		Day 2 (128)		Day 3 (109)		Day 4 (102)		Day 9 (97)	
Source	df	F-value	P	F-value	P	F-value	P	F-value	P
Group	2	7.60	0.0008	7.74	0.0010	5.10	0.0079	5.29	0.0067
Sex	1	0.15	0.701	1.02	0.31	0.19	0.66	0.88	0.35
Age	1	0.80	0.37	1.20	0.28	1.49	0.23	0.20	0.65

[a] shelter – human contact, shelter – no human contact, household
[b] male, female



a-b: P<0.0001; c-d: P=0.016; c-e: P=0.024; d-e: P<0.001; f-g: P<0.0001; h-l: P<0.01

Figure 4.2
LS Means (95% CI) for stress response (salivary cortisol) between treatment, control and baseline dogs

Table 4.6
Arithmetic means, ranges and variances of salivary cortisol levels (ug/dl) for each day by group[a] (n)

	Baseline			Treatment			Control		
	Mean	Range	Variance	Mean	Range	Variance	Mean	Range	Variance
Baseline	0.17 (39)	0.66	0.025						
Day 2a				0.67 (59)	3.31	0.59			
Day 2b				0.46 (54)	1.54	0.19	0.43 (51)	3.61	0.28
Day 3				0.35 (48)	1.69	0.13	0.66 (44)	4.88	0.90
Day 4				0.36 (38)	1.84	0.13	0.47 (45)	4.12	0.58
Day 9				0.36 (28)	1.25	0.075	0.47 (33)	2.35	0.34

[a] shelter – human contact, shelter – no human contact, household

Table 4.7
Effect of sociability level, reactivity level, sex and age on Day 9 stress response (salivary cortisol) (n=26)

Source	df	F-value	P
Sociability level[a]	2	5.69	0.012
Reactivity level[b]	2	7.09	0.0054
Sex	1	4.71	0.044
Age	1	8.35	0.0098

[a] moderate, high, very high
[b] very low, low, moderate

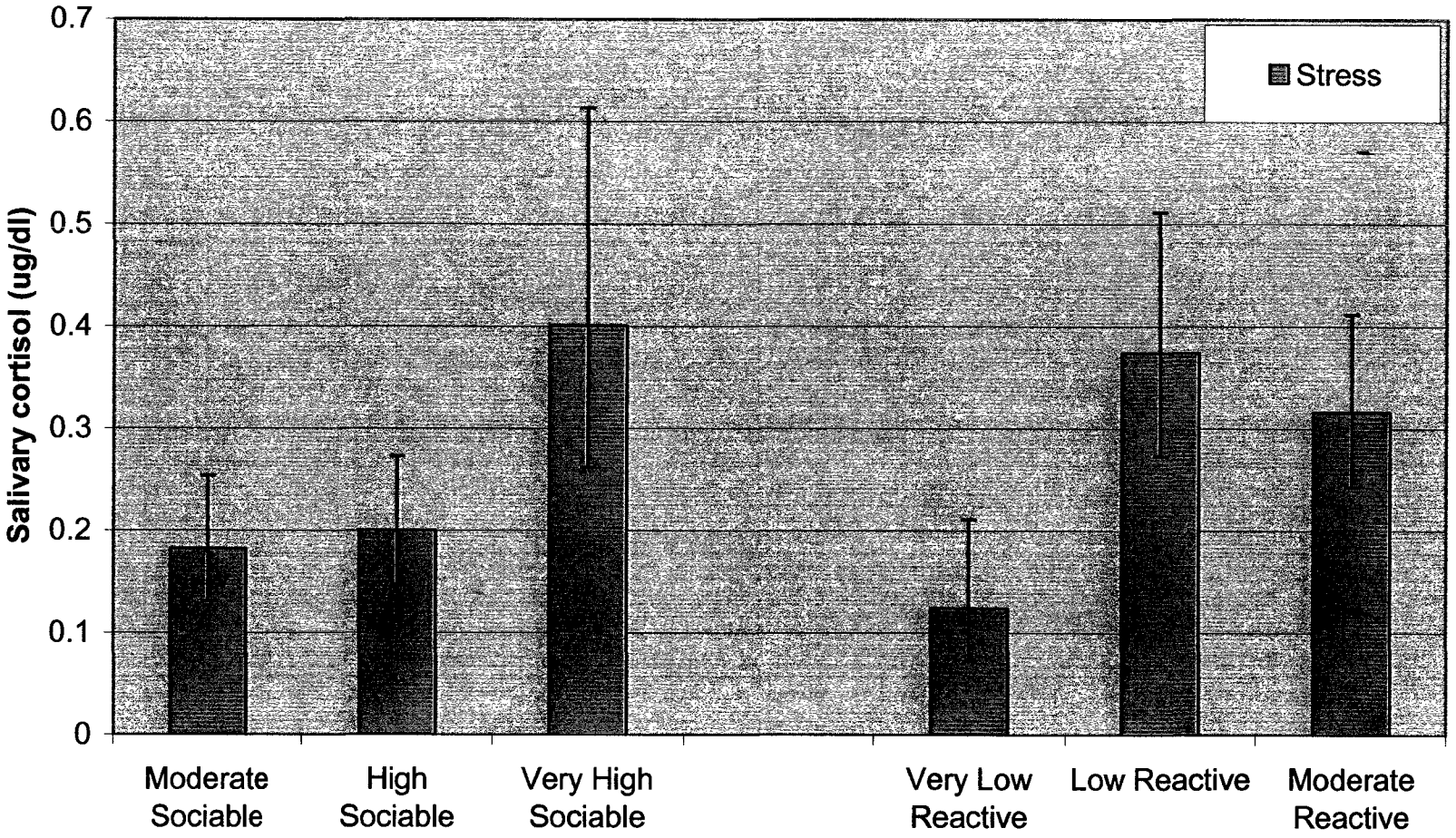


Figure 4.3
Stress response (salivary cortisol) LS means (95%CI) for sociability and reactivity personality levels

progressed from moderately unreactive to highly unreactive cortisol levels decreased (Figure 4.3).

Experiment 3 – Stress Response and Housing Arrangement

The objective of this experiment was to examine the effect of housing arrangement on stress response after being housed in the shelter for at least nine days.

Cortisol levels were analyzed for affect by housing arrangement (single or double). Housing arrangement did not significantly affect cortisol level. Cortisol level was influenced by sex, breed type and source (stray or owner surrendered) ($P<0.05$, Table 4.8). Dogs housed alone had arithmetically higher cortisol levels than dogs housed with a conspecific, and owned dogs had significantly higher levels than stray dogs (Table 4.9). Male dogs housed alone had higher levels than female dogs housed alone or with another dog (Table 4.9).

Survey of Ambient Noise in a Shelter Environment

The noise data was analyzed to determine if there was a difference between frequency of noise levels between dog holding areas at noise thresholds of 70, 80, 90 and 100dBA. There were no significant differences between areas at any threshold level (Table 4.10). The large adoptable and large stray areas were the loudest with over 80% of the time spent above 70dBA and over 30% of the time above 100dBA. The frequency of time each area had noise measurements above each threshold level are displayed in Figure 4.4.

Table 4.8
Effect of housing arrangement[a], sex[b], breed type[c] and source[d] on stress response (salivary cortisol) (n=54)

Source	df	F-value	P
Housing arrangement	1	1.43	0.24
Sex	1	5.62	0.022
Breed Type	3	2.83	0.048
Source	1	4.27	0.044

[a] single, double
[b] male, female
[c] classified by American Kennel Club
[d] stray, owner surrendered

Table 4.9
Cortisol level LS means (SE) for housing arrangement, source, sex and sex by housing arrangement interaction *

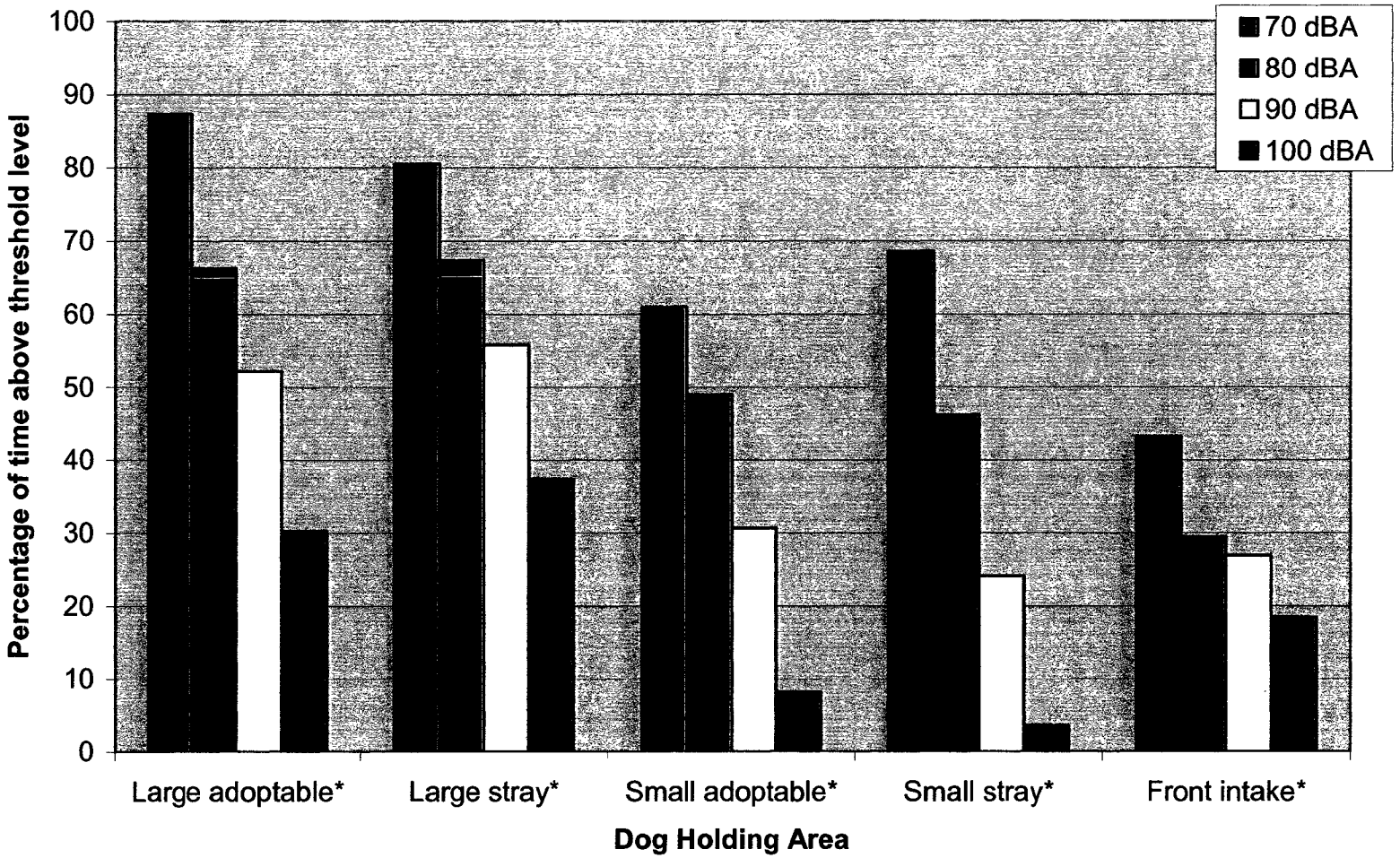
Variable	N	Mean	SE
Single	27	0.191	0.163
Double	27	0.126	0.0345
Stray	48	0.159	0.123
Surrendered	7	0.180	0.102
Male	34	0.187	0.145
Female	21	0.114	0.0473
Male Single	19	0.229	0.181
Female Single	15	0.134	0.0348
Male Double	9	0.110	0.0619
Female Double	12	0.117	0.0318

* Day 9 cortisol level = housing arrangement + source + sex + sex*group

Table 4.10
Effect of dog holding area[a] on frequency of noise measurements above each threshold level

		70 dBA		80 dBA		90 dBA		100 dBA	
Source	df	Chi-square	P	Chi-square	P	Chi-square	P	Chi-square	P
Dog holding area	4	4.05	0.40	3.85	0.43	4.39	0.35	4.13	0.39

[a] large adoptable, large stray, small adoptable, small stray, front intake



* No differences between rooms at any threshold level (P>0.10)

Figure 4.4
Percentage of time spent above each threshold level in each dog holding area

DISCUSSION

Experiment 1 - Adoption occurrence, time to adoption and adoption satisfaction

The large number of dogs being euthanized in the shelters each year is staggering. However the problem is more than just too many dogs, the problem is also housing and marketing dogs as companions (Fennell, 1999). Some shelters have addressed this problem by providing temperament information on adoptable dogs. Temperament information can be obtained by temperament testing dogs shortly after their arrival to the shelter. Temperament assessments can also indicate which individuals are not appropriate for adoption. While some shelters provide temperament information not all shelters incorporate it into their standard operating procedure. Temperament testing may not be a priority because its inherent value to the adoption process is not known.

Temperament tests are helpful in preventing dogs that have a potentially high return rate from being adopted. These dogs are usually aggressive (dog, owner, cat, child, resource) or extremely unsocialized. Additionally, temperament tests can provide information to potential owners so they can make better informed decisions on which type of dog will be most appropriate in their home. Useful personality information on adoptable dogs includes level of playfulness

with people, dogs and toys; level of reactiveness to startling objects and sounds; level of aggressiveness with other dogs, level of obedience and training and any indications of existing or predisposition for separation anxiety. These traits can assist owners in finding a dog that is appropriate for their household, will meet their expectations and needs and informs owners of potential behavioral concerns. The availability of personality information may also assist owners in choosing a companion dog in a shorter length of time.

Accurate temperament assessment of an adult shelter dog is different from assessing owned dogs in a household and may need to be specific to the shelter environment (Goodloe and Borchelt, 1998). There are currently many different temperament tests being used at shelters around the country but only one has been validated for shelter dogs (Ledger and Baxter, 1997). A test developed by Sue Sternberg (1998) has not been validated but has become increasingly popular with shelters. Some tests are not designed to evaluate temperament levels in individuals but rather to identify canine personality traits (Cattell and Korth, 1973; Draper, 1995; Hart and Hart, 1985; Goodloe and Borchelt, 1998; Svartberg and Forkman, 2002) while others evaluate service potential (Serpell and Hsu, 2001; Dietrich, 1984) or predict problem behavior (van der Borg et al., 1991).

The temperament test utilized in the present experiment to provide temperament information on adoptable dogs was a variation of Ledger and Baxter's (1997). The livestock task and food arrival/removal was excluded from

the present experiment while tasks involving reactivity responses, separation related behavior and play behavior were added.

The present experiment evaluated the use of information derived from a temperament assessment to increase adoption occurrence. The temperament test was conducted on the 2nd day of housing in the shelter, information gathered from the temperament test was made available to potential adopters so they could make an informed and educated decision about which dog was most appropriate for them. The posted information was also helpful to shelter staff when they were assisting to match dogs with potential adopters.

It may be assumed that the shelters routinely utilize information derived from their temperament assessments in the same way but that is not necessarily the case. Some shelters only test dogs for adoption potential and do not evaluate temperament. This study was designed to give evidence of whether providing information on a dog's temperament to potential adopters would improve the adoption process in terms of higher adoption numbers, shorter time to adoption and satisfaction with the adopted dog as a pet.

The results from the present study indicate dogs with available temperament information as companion animals were more likely to be adopted and were adopted in a fewer number of days (Figure 5.1). A higher percentage of dogs were adopted from the treatment group than from the control group (P=0.036). Treatment dogs were not only more likely to be adopted but they were also adopted in a shorter number of days. It is worth mentioning that control dogs continued to be adopted despite the lack of temperament

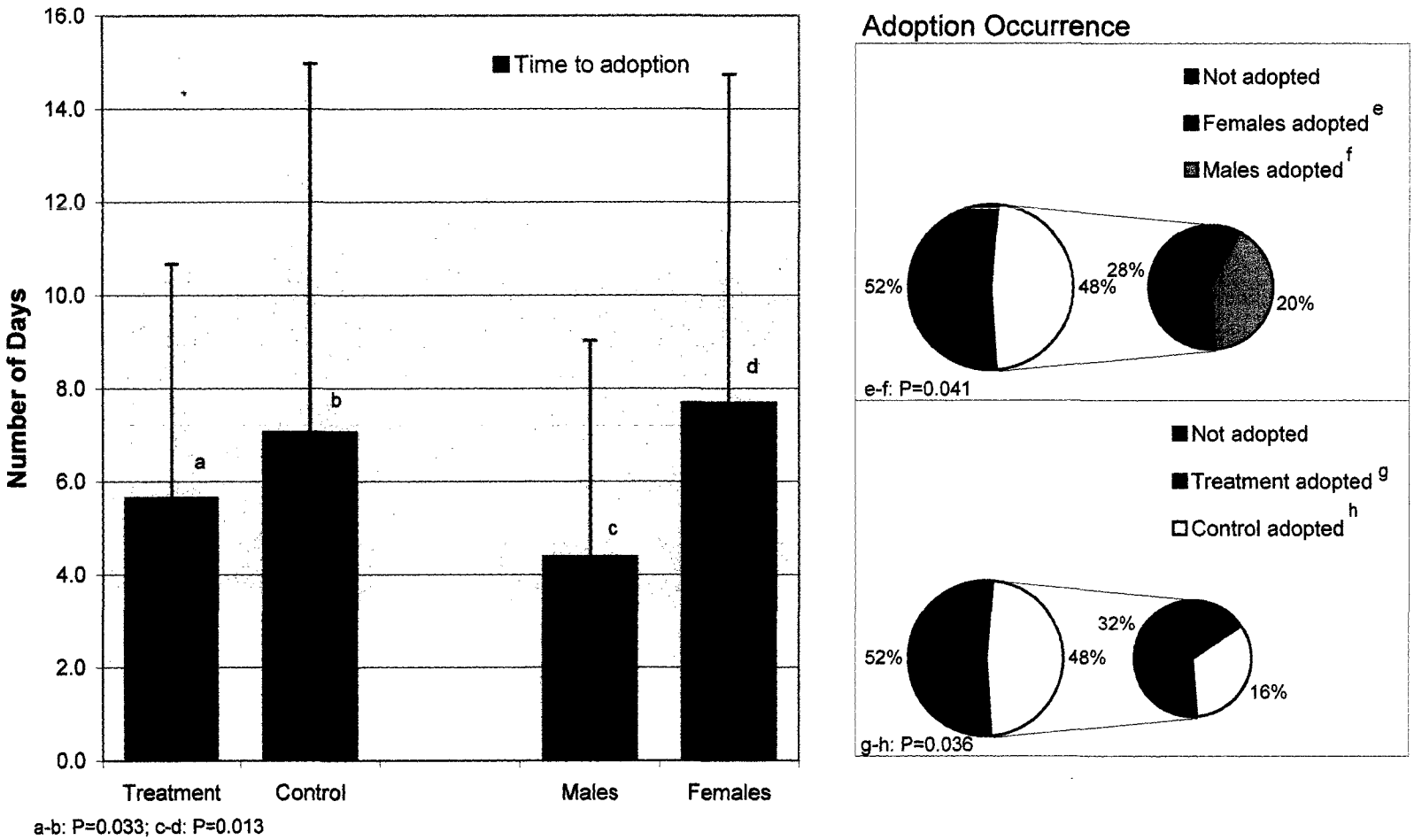


Figure 5.1
Time to adoption (SE) and adoption occurrence for treatment and control dogs and male and female dogs

information available. However, it was observed by the researcher and shelter staff that potential adopters were asking the shelter staff more applicable questions about the control dogs' temperament. This occurred after they observed temperament information on the treatment dogs. It was impossible to control for this placebo effect in the shelter setting.

The results also indicate that female dogs were adopted more often than male dogs (Figure 5.1). Seventy-six percent of all females available for adoption were adopted while only 45% of all males were. The reason for this is not definitively known and may be due to a general preference for female dogs as a companion. This could be due to perceived gender-specific undesirable behavior i.e. marking, roaming, mounting etc. All dogs obtained from the shelter are required to be reproductively altered so the prospect of breeding an adopted dog was not a factor.

Male dogs however were adopted in a fewer number of days even though they were not adopted as frequently as females (Figure 5.1). The preference for male dogs may be less than for females but strong in a small population of the general public. This strong preference for a male dog may facilitate a quicker decision when choosing a desired companion animal.

Since temperament information for the treatment dogs was available, the effect of personality traits on adoption occurrence was examined. Based on information gathered from the temperament tests, eight personality trait levels were derived. Each trait had a range from very low → low → medium → high → very high. The traits assessed in this study were based on traits that were

believed to be relevant to adoption potential. Aggression however was not analyzed because any dog identified as aggressive was not eligible to participate in the study. It was my a priori prediction that playfulness and sociability would be the most influential on adoption occurrence.

In the present experiment, none of the personality traits (reactivity, playfulness, independence, fear, sociability, confidence, calmness and gentleness) evaluated were found to have a significant effect on whether a dog was adopted. There was however a slight tendency for level of calmness and level of gentleness to have an influence on adoption occurrence. The reason for this is not definitively known but I would speculate that there is not a wide variation for desired levels of gentleness and calmness and most owners prefer a dog with moderate to high levels of these two traits. It would appear that for most of the traits evaluated there is a possibility for varying levels of each trait to be desired by potential owners. For example, some owners may want a very playful dog while others may only want a moderately playful dog, depending on their lifestyle and needs, the same can be assumed for reactivity, independence, sociability and confidence. The reasonable exceptions to this are gentleness, calmness and fearfulness. Whereas the majority of dog owners would consider a gentle and calm dog to be most desirable and there may not be a market for companion dogs that are not calm or gentle. In regards to fearfulness, there was not a large variation in our subjects for this trait. The majority of our dogs were moderately unfearful with only a couple of outliers in the very fearful level. This lack of variation may have prevented significant differences from being detected.

In this data subset, shorter dogs were more likely to be adopted. This tendency may simply be due to supply and demand in the available pet population. This agrees with results reported previously (Posage et al., 1998). As a general rule, there were always fewer small (adult) dogs available for adoption than large (adult) dogs. It is not uncommon for the adoption of small dogs to not be a problem in animal shelters while there is consistently an overpopulation of large dogs. In addition, small dogs may be considered suitable for more types of households i.e apartments, small houses, houses with no fenced yard. Small dogs are also popular companions for elderly persons.

When evaluating the factors affecting adoption occurrence it is very hard to overcome potential adopters' preconceived ideas of stereotypies of certain breeds and the superficial desires of an owner regardless of temperament. It was observed that some people simply desired a certain breed or certain physical characteristics and temperament was not a factor for consideration. Presently, most dogs are selected for appearance rather than function or temperament (Posage et al., 1998). It could be speculated that these adopted dogs were at the greatest risk for adoption failure.

To my knowledge, the effect of available temperament information on adoptable adult dogs on adoption occurrence and time to adoption has not been studied. The primary reason for conducting this study was to provide data on the benefits of providing temperament information on adoptable dogs. Presently, many shelters across the country do not provide temperament information for their dogs but rather rely on potential adopters to assess temperament for

themselves. Some of the reasons shelters may not provide temperament information may be due to the expense of hiring a qualified person to conduct a temperament assessment, interpret the results and convey this information to the public in an easily understood format. However, more shelters are realizing the many benefits of having a behaviorist on staff. The results of this study indicate that providing temperament information can facilitate the adoption process. A greater number of animals move more quickly through the shelter adoption system and generate increased revenue. The temperament information posted may also allow potential adopters to reduce the amount of time required to find an appropriate dog and thus reducing the amount of employee time required in assisting them.

Due to a low response rate on the follow-up interviews, satisfaction with the adopted dog as a pet could not be evaluated. The county in which this study took place is largely rural and the primary city of Greeley has a large college population. At the time of the follow-up interview (6 weeks after adoption) more than 50% that had previously agreed to participate were no longer available for contact. This was due to disconnected phone numbers, invalid addresses, invalid phone contacts, nonreturned phone messages (>4) and unwillingness to participate. From the responses we did receive, the outcome was generally the same if they still owned the dog, i.e. yes, they were happy with the dog and yes, they would adopt him/her again knowing what they know now. Based on some of the responses received there appeared to be a bias for the answers to be positive regardless of the true sentiment toward the adopted dog.

This entire study had the primary limitation that it was being conducted in the field. Sometimes the objectives of the animal shelter conflicted with the objectives of the adoption study. Before the study started, we obtained a cooperation agreement with the shelter's executive director and we outlined what assistance would be needed from the shelter and its staff. However, the executive director was replaced twice during the duration of the study and shelter employees did not adhere to procedures agreed to by the initial executive director. There was also a high employee turnover rate, which made it difficult to keep employees educated on the study's protocol.

Since the animal shelter was constantly overpopulated with adult dogs some study animals were transferred before they had an opportunity to fully participate in the study. Another limitation of the study was that shelter employees were needed to complete a portion of the adoption paperwork and study protocol was not always followed. This study was originally designed to evaluate 200 adult dogs available for adoption, due to restrictions of the shelter setting the study was stopped after approximately 130 dogs were entered and 88 were made available for adoption for at least one day.

Experiment 2 – Stress Response and Human Contact

For dogs, structuring a human contact session into introduction procedures shortly after arrival to the shelter may alleviate stress. Interactions with humans have been shown to reduce some stress for dogs while housed in the shelter (Hennessy et al., 1997 and 1998) and petting a dog eliminated stress

from electric shock (Lynch and McCarthy, 1967). The shelter environment does not normally promote positive social interaction with humans and a controlled positive contact session with a human can be influential in decreasing stress response and facilitating acclimation to the facility and its stressors.

Stress response was measured using salivary cortisol levels on days 2, 3, 4 and 9 in the shelter. Stress responses were compared between the control and treatment groups. Both shelter groups (control and treatment) were analyzed 1) together to examine effect of the human contact session and 2) were compared to a group of household dogs (baseline). Based on results from the comparison of the two shelter groups, it was concluded there were no differences on days 2, 4 and 9 but there was a significant difference on day 3. On day 3, the treatment dogs had a much lower cortisol level than the control dogs (P=0.014). The stress response trend seen in previous research (Hennessy et al., 1997) was evident in the control group but not in the treatment group. The treatment group's cortisol level decreased from day 2 to day 3, then increased slightly to day 4 and remained at approximately the same level until day 9. Previous research indicates that a dog's cortisol level begins to rise on day 2, peaks on day 3-4, decreases until day 9 and then plateaus around day 9-10 when housed in a shelter environment (Hennessy et al., 1997 and 1998). In the present study, treatment dogs did not experience an increase in cortisol level after day 2 and therefore did not have a peak in cortisol level on day 3 (Figure 5.2).

In the present study, day 3 cortisol levels were higher, on the average, than any other day measured. This was especially true for the control dogs. The

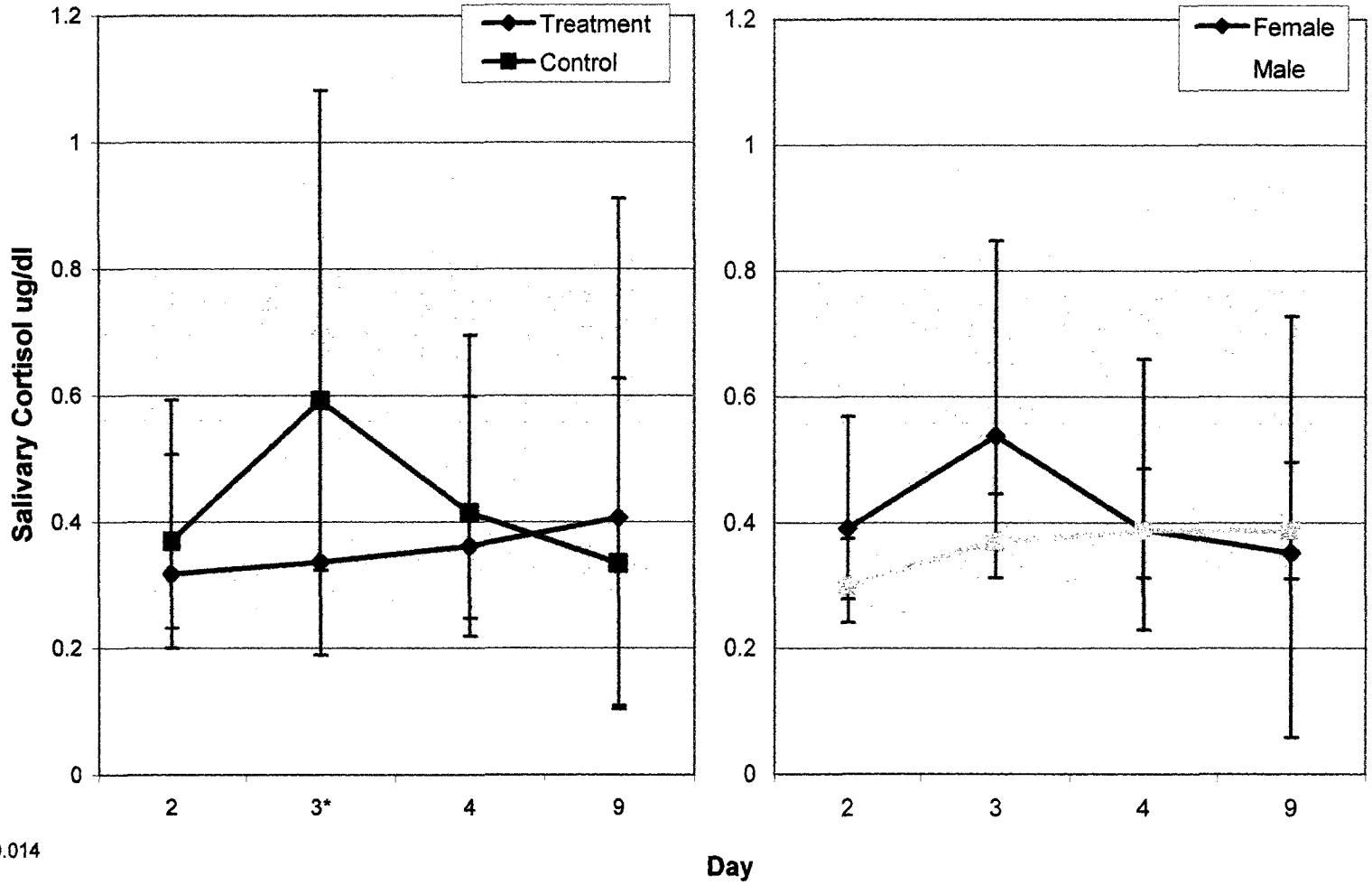


Figure 5.2
LS Mean stress response (day 2 – 9) (95% CI) for treatment and control dogs and male and female dogs

only difference between the two shelter groups was that the treatment dogs participated in a human contact session the 2nd day after their arrival at the shelter. This human contact session entailed getting to know the dog, petting and grooming the dog, playing with the dog and allowing the dog to interact with a human for approximately 30 minutes. This one time session may have eliminated the stress spike observed in the control group on day 3. In addition, the human contact session had an overall reducing effect on stress response for the first 9 days. While there were no statistical differences in stress levels between the dogs that received a human contact session and those that didn't on day 9 (P=0.55) there were differences prior to that day. The goal of an animal shelter is to move a dog through the facility in the shortest time period possible. If a dog is less stressed during the earlier portion of its stay it may be adopted more quickly and/or maintain a more tolerant immune system. This human contact session also allows a shelter employee to be more familiar with the dog's personality and facilitate its adoption with compatible owners.

In accordance with previous studies' results (Garnier et al., 1990) females may be experiencing more stress than males (Figure 5.2), the difference between the two sexes was not significant but females did have numerically higher cortisol levels. Males appeared to acclimate to their stressful surroundings more quickly than females; however once both sexes did acclimate, they did so to approximately the same level. This is in accordance with the findings that baseline cortisol levels do not differ between sexes (Reimers et al., 1984; Reimers et al., 1990). This initial difference may be due to female

hormone levels but I speculate it is more likely females are simply more sensitive to their surroundings and respond more strongly to stressful stimuli. Previous studies indicate females show an increased acute stress response when compared to males (Beerda et al., 1999a; Beerda et al., 1999b). It is also possible that females require more than males time to adjust to their surroundings.

The shelter dogs (control and treatment) were also compared to normal household (baseline) dogs in regards to stress response. This appeared to be the most appropriate approach since there were no true "unstressed" dogs in the shelter. This comparison has been used in previous research (Hennessy et al., 1997). Throughout the study, both shelter groups had considerably higher cortisol levels than the baseline group (Figure 5.3). On day 2, shelter dogs had a cortisol level 57% higher than household dogs, on day 3 control shelter dogs had a cortisol level 60% higher while treatment dogs were only 38% higher, day 4 cortisol levels were 53% higher in the shelter dogs and on day 9 cortisol levels in the shelter remained 50% higher than normal household dogs. By day 9, dogs are considered to be as adjusted to their surroundings as they will become and yet their stress level is still twice that of normal household dogs (P=0.0067).

Since cortisol level is affected by many stressors and has a high degree of individual variation it is often difficult to make definitive conclusions about the benefits of stress reducing procedures. The range and variance for unstressed dogs (baseline) was noticeably lower than stressed dogs (control and treatment). However, the two shelter groups had different trends from each other. The

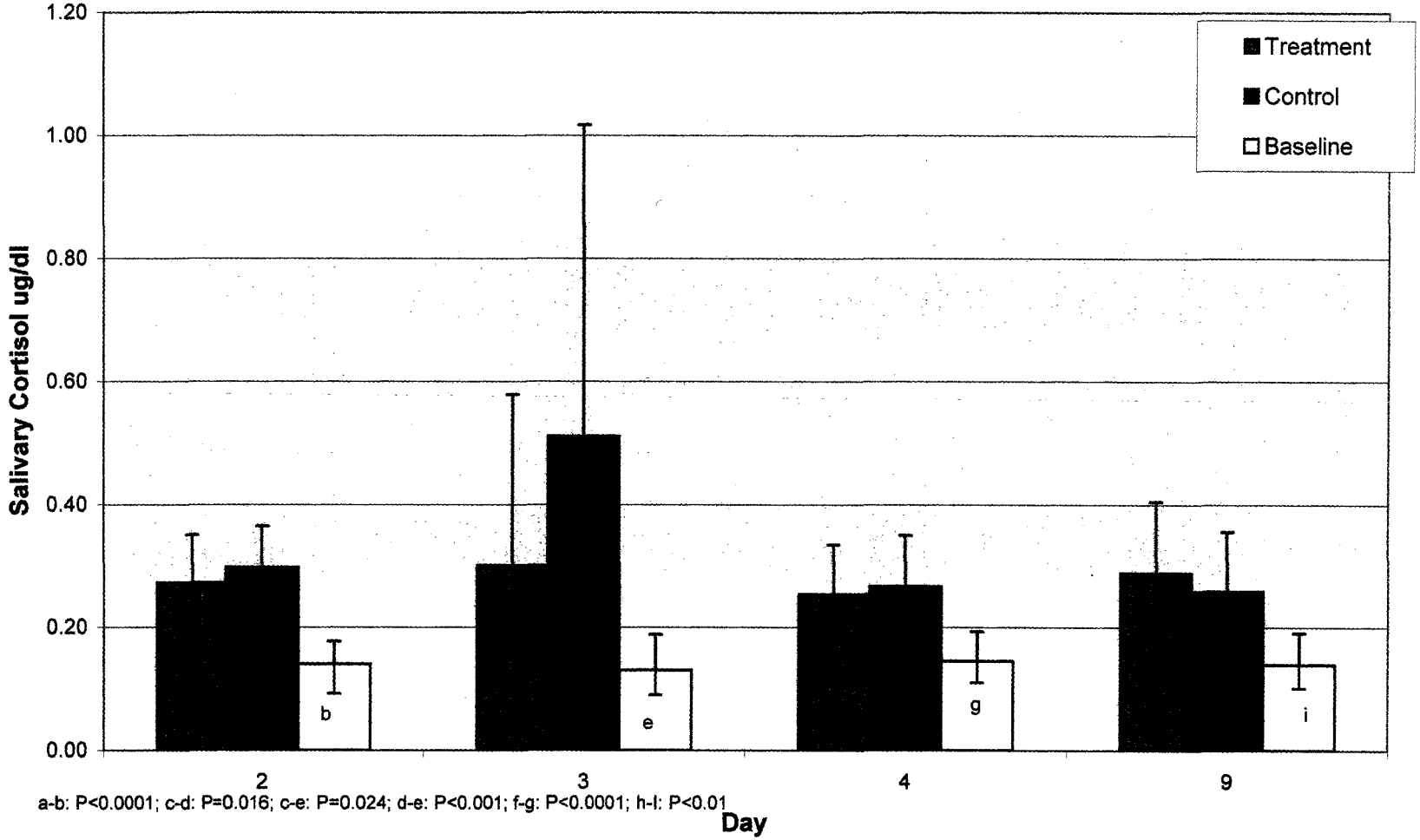


Figure 5.3
Least square means (95% CI) (day 2 -9) for treatment, control and baseline dogs

treatment group's cortisol level range and variance decreased consistently from day 2 to day 9 whereas the control group's range and variance fluctuated from day to day.

In this study, salivary cortisol level was influenced by two personality traits. Cortisol levels on day 9 were lower in dogs that had a lower reactivity level to novel and irritating sounds and objects and to be higher in dogs that were more sociable (Figure 4.3). Since it has already been concluded by previous researchers that the shelter environment is stressful to a dog because of two main factors, social isolation and novel surrounding and stimulation (Hennessy et al., 1997), these results were not surprising.

The more social a dog is with either humans or other dogs the more vulnerable he is to isolation from these social contacts. In many instances, the shelter environment does not allow for positive social contact or interaction and this can have adverse affects on an extremely social animal like the dog. The more social the dog appeared to be based on a temperament assessment conducted on day 2 the higher his salivary cortisol levels were on day 9. It appeared that a highly social individual experienced a higher stress response to social isolation/minimization than individuals that were not as social. Even though the cortisol levels were obtained from dogs that had participated in the human contact session on day 2, we do not feel this had an impact on day 9 stress response. The human contact session on day 2 did not have an effect on cortisol levels this late in the shelter stay and individual acclimation level was primarily influenced by previous experiences and temperament.

The less reactive the individual dog appeared to be to novel sounds (car horn, bicycle horn, chain rattling, electronic mouse, clapping of hands, dogs barking etc.) and novel stimuli (remote control cars, heavy chain, umbrella, camera flash etc.) the lower his cortisol level was on day 9. This may be because this type of individual is either more passive in his reactions to novel, irritating stimuli or is simply less affected by it.

The third day in the shelter can be considered the most stressful for dogs. This may be because they have not yet begun to acclimate; have reached their tolerance level for novel, irritating stimuli and/or are responding to unpredictable surroundings. By understanding which individuals (female, more sociable, less reactive, owner surrendered, older) may require preventative measures to reduce stress and improve animal welfare animal shelters and humane societies may be able to implement a stress prevention procedure that is beneficial to all dogs but also targets extremely vulnerable/susceptible dogs.

The results from Experiment 1 indicate that dogs with temperament information available were adopted more often and more quickly. It is reassuring that the adoption process could be improved in terms of numbers and time to adoption. The greater number of dogs adopted, in less time, allows more dogs to be made available to the public. This facilitates dogs available for adoption to progress more quickly through the shelter system and endure less time in the stressful environment. The number of days a dog is housed in the shelter while waiting to be adopted can be unnecessarily extended because of overcrowding on the adoption floor. When dogs are not adopted from the adoption area a

bottleneck effect occurs for the dogs that are waiting in the stray area for their turn on the adoption area and for the dogs being received by the shelter daily.

Given that a human contact session can serve two functions in the shelter: 1) as a behavior assessment for adoption potential and temperament information and 2) to alleviate stress for the dogs it should be considered as part of a standard intake procedure to improve both animal welfare and adoption success.

This experiment, stress response and human contact, was not as greatly limited by confusion in the facility as Experiment 1 but was still restricted by the chaotic shelter atmosphere. It was not possible to collect saliva samples on some dogs that had not yet been adopted because they were removed from the facility prematurely. Since the study was being conducted with only one primary researcher it was sometimes impossible to collect saliva from dogs that required more than one person for restraint.

Experiment 3 – Stress Response and Housing Arrangement

Housing design for dogs in a shelter environment is usually based on husbandry convenience. In most shelters dogs are preferentially housed individually and social contact is restricted. Dogs however are extremely social by nature and require social enrichment to maintain good psychological well-being (Wolfe, 1990; Fox, 1986). Despite previous findings that dogs housed either in compatible groups or pairs has many benefits (Mertens and Unshelm, 1996), individual housing has remained the norm. The resistance to housing dogs together is primarily because of the increased labor involved to identify

compatible groups or pairs, to separate at feeding time if necessary, to constantly observe the dogs to break-up fights if necessary and the concern for injuries from fights (Mertens and Unshelm, 1996). However, studies have examined the behavior of dogs housed together and have concluded that when dogs are appropriately paired or grouped together and housed in an adequate size kennel they rarely engage in fighting behavior and actually spend more time resting than dogs housed alone (Hughes et al., 1989; Hetts et al., 1992). Dogs housed together were also found to spend less time vocalizing, were adopted more often and returned to the shelter less often (Hetts et al., 1992; Coppinger and Zuccotti, 1999; Mertens and Unshelm, 1996).

In this present study, we examined the effect pair housing had on stress response, measured by salivary cortisol levels, when the dogs had been housed in the shelter for at least nine days. We compared these cortisol levels to dogs that were housed individually in the same dog holding area at the same time. Due to high individual variation in cortisol levels, it may not have been possible to detect a statistically significant difference between the two groups. Dogs housed alone had higher cortisol levels than dogs housed with a conspecific (0.191ug/dl vs. 0.126ug/dl) but it was not significant (P=0.24). There was also an interesting significant difference between males and females and whether the dog was brought to the shelter as a stray or was owner surrendered.

In this data set it was concluded that males had higher cortisol levels than females and were thus experiencing more stress. This is in contrast with the implications from Experiment 2 where females may be more vulnerable to the

stressful environment and had higher cortisol levels than males. Previous research agrees with the findings of experiment 2, in which females respond more to a stressful environment than males (Beerda et al., 1999a and 1999b). The present experiment however evaluated social isolation specifically and stress response was measured at a point when acclimation to the otherwise stressful shelter environment had presumably already occurred. When the categories of male and female were separated by housing arrangement it became clear which group was indeed the most stressed (Figure 5.4).

Males housed individually had much higher cortisol levels than males housed with another dog. In addition, males pair housed had relatively the same cortisol levels as females housed individually or females housed with another dog. There was not a difference in cortisol level between females housed alone or with another dog. Our interpretation of this data would be that females are not as significantly affected by social isolation and that social isolation is a powerful stressor for male dogs when housed in the shelter. We are not however concluding that female dogs do not require social contact, we are merely speculating that the absence of social contact is more detrimental to males than it is to females. Another reason may be that male dogs become more stressed than female dogs when they can see, hear and smell other dogs but their access to them is restricted.

One of the primary psychological stressors for a dog is lack of control over its surroundings (Seligman, 1975). Individual housing may contribute to a dog's lack of control and result in a higher stress response. Males may be more

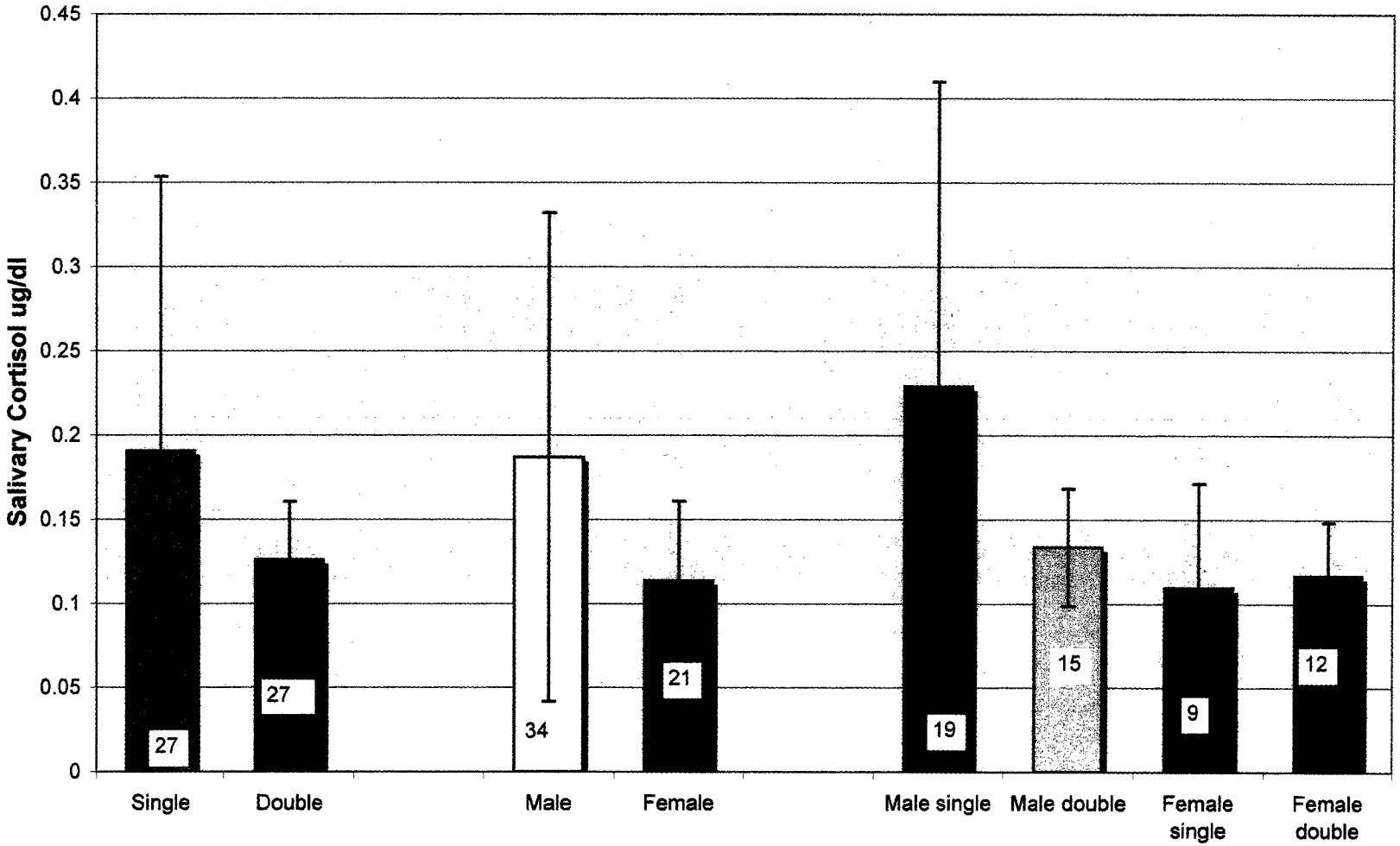


Figure 5.4
Means (SE) for single and double housed dogs, male and female dogs and sex by housing interaction

vulnerable to this specific stressor. According to one researcher (Hubrecht et al., 1992), social contact allows for some control in an otherwise uncontrollable environment.

Another influence on cortisol level after being housed in the shelter for nine days was source. Owner surrendered dogs had higher (>10%) cortisol levels (P=0.044) than stray dogs even though 5 of the 7 surrendered dogs were pair housed. In this shelter, there were fewer dogs owner surrendered in comparison to dogs brought in as strays (7 vs. 47). Owner surrendered dogs are probably the most affected by the stressful shelter environment. Surrendered dogs are usually directly from a household where a human-animal or animal-animal bond has just been broken (Sternberg, 1998). This group of dogs does not have an adjustment period to get used to the broken bond(s) and the abrupt cessation of social contact. Owner surrendered dogs are also brought to the shelter by their present owner and may require more time than a stray dog to stop waiting for their owner to come back and get them. This group may benefit the most by a human contact session after arrival to the shelter to assist in their adjustment of being away from their owner. It is however possible that they will require more than one human contact session in order to reduce stress by any considerable amount.

To my knowledge, cortisol levels have not been compared between dogs that are housed individually and dogs that are housed in pairs. Previous research only indicates the behavioral benefits and positive influence on adoption rates and returns. While this data set, with its high individual variation, may not

definitively conclude pair housing reduces stress response there are strong indications that it may. Since dogs housed in pairs had numerically lower cortisol levels than dogs housed alone combined with the other beneficial effects of pair housing, housing dogs together appears to be the best option from a welfare and financial aspect.

This experiment was added to the study after some of the primary limitations of researching in a shelter were realized. This experiment did not require any assistance from the shelter employees and did not require the dogs to participate after the initial saliva sample. The same limitation (as in Experiment 2) of sometimes needing more than one person to collect saliva however was present. Despite efforts by the shelter staff, dogs housed together were not always compatible and it is very possible that some dogs were not enjoying the positive aspects of pair housing indicated by previous research.

Survey of Ambient Noise

Even in a new facility a design to eliminate noise has been disregarded, despite the evidence that noise inflicts physical and psychological stress on dogs (Wei, 1969). The large adoptable area houses the greatest number of dogs and results indicate it was the loudest. However, it was not significantly louder than the other dog holding areas. It receives a large amount of human traffic and noise from this area overflows into every other area of the shelter. There are hallways leading from the large adoptable area that serve as noise conduits to the other areas – one stopping at cat adoptable and cat stray and the other

ending at the small adoptable room. The large adoptable area is also located directly next to large stray, small stray, isolation, animal control, grooming and two visitation rooms. Animals in the large adoptable and large stray areas spent approximately 80% of the time in noise levels over 70dBA and over 30% of the time in noise levels over 100dBA (Figure 5.5).

Noise produced by an individual dog barking can reach levels well over 100dBA and this exceeds OSHA regulation for workers (90dBA) (Sales et al., 1996). However, the animals live in this environment without the hearing protection that is available and sometimes required for people. The noise affect is three fold: 1) the animals housed in the shelter, 2) the employees working at the shelter and 3) the public visiting the shelter looking for an animal to adopt. The animals' mental and physical states are compromised, the employees may be subjected to hearing damage in addition to not being in the best state of mind to care for the animals and the public is so overwhelmed by the noise and its irritating and sometimes painful nature, that they do not stay very long looking for an animal to adopt.

The large adoptable area is designed so that every dog can see every other dog if they are at their kennel doors. We observed that this layout allows for constant stimulation and increased barking, a building design that is specifically advised against by the Humane Society of the United States (HSUS, 1981). It is impossible to do anything associated with the large adoptable area without stimulating every dog in the area. The result is constant barking. The work area for this room is also located in the center of the rectangle – resulting in

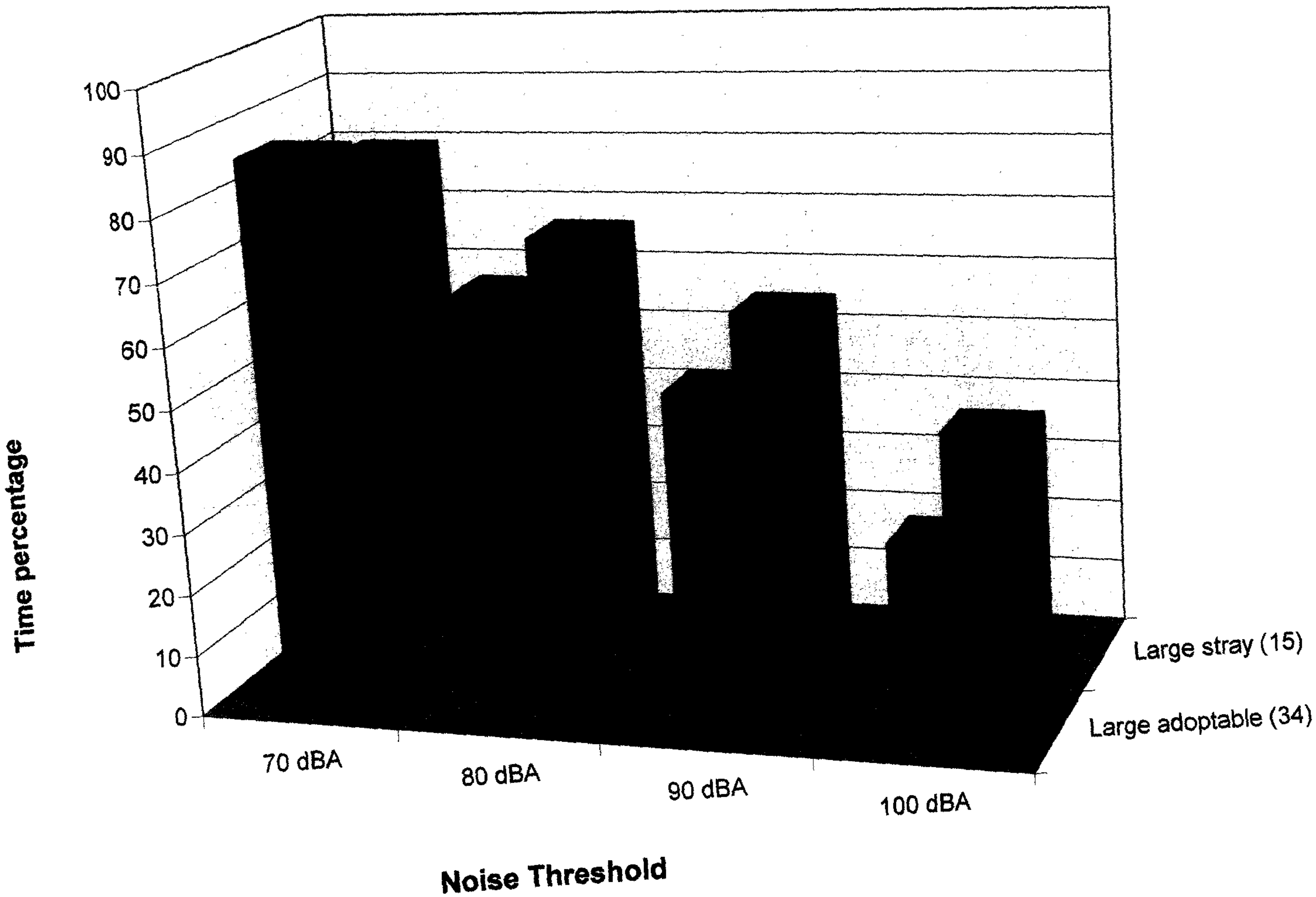


Figure 5.5
Percentage of time spent above each threshold level (70, 80, 90 and 100dBA) in large adoptable and large stray areas

constant stimulation. The facility was also not designed to allow for comfortable group housing. Previous research has shown that group housing decreases noise caused by animal vocalizations and that the animals spend more time sleeping (Hetts et al., 1992; Mertens and Unshelm, 1996).

The physical design does not allow for significant noise absorption and noise reverberates. The rooms with suspended ceilings do allow for some absorption resulting in somewhat lower noise levels. The viewing design for the public also contributes to the amount of stimulation for the dog. The viewing window starts half-way up the perimeter wall with the lower half consisting of concrete, coupled with the concrete partitions in between every kennel, the dogs are constantly being surprised by people walking by and suddenly coming into view with no prior indications – scent, sound or view.

In the shelter environment, cortisol levels have been documented to be above normal, three times that of household pets (Hennessy et al., 1997) and they were also above in this shelter. Not all stress-induced elevations in cortisol are due to noise levels but they are definitely a contributing factor.

As previous scientists have noted, kennels should be designed to meet the behavioral and physical needs of dogs in order to ensure their welfare and this includes optimal ranges for sound (Sales et al., 1993; Key, 2000; Sales et al., 1997). There are many publications that outline the "dos and don'ts" for shelter design and construction yet kennels are continuing to be built where noise is a hazard to both the animals and the employees. Since it has been proven that the shelter is a stressful environment for a dog due to its unpredictable and

uncontrollable nature any other stress-inducing stimulus that can be reduced or eliminated needs to be addressed. If shelters were to follow the standards for human dwellings, a mean sound level of 45dBA would be the norm (Algers and Ekesbo, 1977).

Implications

Dogs are a popular source of companionship for much of the world's population. They are also increasingly used for sport and service activities and yet despite being referred to as "man's best friend" abuse of companion dogs is prevalent (Rollin, 1991). Many dogs are killed each year because owners are unaware of their basic needs and the fundamental aspects of their natural behaviors (Rollin, 1991). Through research and continuing education of not only pet owners but also the general public, companion animal welfare can be improved.

Good animal welfare is a concern for scientists, veterinarians, animal caregivers and the general public. However, the welfare of companion animals, especially dogs, in an animal shelter has been largely disregarded. The welfare of dogs in this stressful environment can first be improved by removing them from the shelter in the shortest amount of time possible, this can be achieved by increasing adoption occurrence and decreasing time to adoption. Second, while dogs wait in the shelter to be adopted stress reducing procedures can be implemented. These procedures include regulating noise levels, providing

kennel enrichment, pair or group housing and designing the facility so that the dogs are negatively stimulated as little as possible.

The provision of temperament information on adoptable dogs to potential adopters facilitates dog adoptions and reduces the number of days a dog waits in the shelter to be adopted. Dogs that are adopted more quickly are exposed to the stressful environment for less time. The increased adoption rate also benefits other dogs that are waiting for an available space on the adoption floor. Dogs that spend less time waiting to be adopted are less susceptible to stress induced behavior problems and are less vulnerable to stress induced illnesses.

Improving animal welfare in a shelter is beneficial not only to the animals but also to the shelter employees and the general public visiting and supporting the facility. Dogs with improved welfare are adopted more often and more quickly and are less susceptible to behavior problems and illness. Shelter employees benefit by working in a less stressful environment in terms of noise and overcrowding problems that result in higher euthanasia rates. More content employees also allows for better animal handling and public interaction when looking for a dog to adopt. An enriched shelter environment is not only beneficial for the animals housed there and for the employees working there but creates a positive image for the shelter, which brings in the general public more often. Two of the reasons the general public does not visit an animal shelter when looking for a new companion animal are because it is too depressing to see all the animals in cages knowing they are at risk for euthanasia and because the shelter can be noisy. A less depressing and quieter shelter invites the public to utilize

the shelter as a primary animal source and to spend more time in the facility looking for the appropriate companion animal. This is turn increases adoption numbers and rate and allows animals to move through the system more quickly, experiencing a smaller amount of stress for a shorter period of time.

All of the above positive aspects also benefit the shelter financially. The shelter receives more money from adoptions and contributions, invests less in each animal (food and housing), spends less money on medical treatments and potentially has a lower employee turnover rate.

The results from this series of experiments indicate there may be ways to improve the adoption process of adult shelter dogs and improve animal welfare. Due to the increased euthanasia rate, further research needs to be conducted to definitively outline procedures that will increase adoptions, decrease time to adoption and increase retention and satisfaction. Research also needs to be done to validate a temperament test, practical for the shelter setting, that can be used to provide accurate temperament information to potential owners. In light of the fact that the shelter environment is extremely stressful for dogs, stress reducing procedures need to be further tested for their effect on stress response. In addition, building design factors need to be evaluated and addressed for their contribution to the stressful environment. Temperament evaluations and stress reducing procedures in an animal shelter are not only beneficial but also practical and should become the standard instead of the exception.

REFERENCES

Algers B. 1984. A note on the behavioural responses of farm animals to ultrasound. Applied Animal Behaviour Science 12:387-91.

Algers B, Ekesbo I. 1977. Bullermatniorgar djurmiljoer. Svensk Veterinartidning 7:29.

Algers B, Ekesbo I, Stromberg S. 1978. Noise measurements in farm animal environments. Acta Veterinaria Scandinavica supplementum 68:1-19.

Allport GW. 1961. Pattern and growth in personality. New York: Holt, Rinehart and Winston.

American Society for the Prevention of Cruelty to Animals. Annual Shelter Statistics [Web Page]. Located at: http://www.aspca.org/site/pageserver?pagename=annualshelterinfo. Accessed 2003 Dec 12.

Anderson DE, Tosheff JG. 1973. Cardiac output and total peripheral resistance changes during preavoidance periods in the dog. Journal of Applied Physiology 34(5):650-4.

Anthony A. 1963. Criteria for acoustics in animal housing. Laboratory Animal Care 23:340-50.

Babisch W. 2003. Stress hormones in the research on cardiovascular effects of noise. Noise & Health 5(18):1-11.

Baker DE. 1998. Equipment decibel levels. Grounds Maintenance 33(3):73.

Bartlett CR. 1976. Heritabilities and Genetic Correlations Between Hip Dysplasia and Temperament Traits of Seeing Eye Dogs. Rutgers University: Rutgers University. Masters thesis .

Bassett JR, Marshall PM, Spillane R. 1987. The physiological measurement of acute stress (public speaking) in bank employees. International Journal of Psychobiology 5:265-73.

Beaver BV. 1981. The genetics of canine behavior. Veterinary Medicine / Small Animal Clinician :1423-4.

Beerda B, Schilder MBH, Bernadina W, Van Hoof JARAM, De Vries HW, Mol JA. 1999b. Chronic stress in dogs subjected to social and spatial restriction. II. Hormonal and immunological responses. Physiology and Behavior 66(2):243-54.

Beerda B, Schilder MBH, Van Hooff JARAM, De Vries HW, Mol JA. 1999a. Chronic stress in dogs subjected to social and spatial restriction. I. Behavioral responses. Physiology and Behavior 66(2):233-42.

Beerda B, Schilder MBH, Janssen NSCRM, Mol JA. 1996. The use of saliva cortisol, urinary cortisol and catecholamine measurements for a noninvasive assessment of stress response in dogs. Hormones and Behavior 30:272-9.

Beerda B, Schilder MBH, van Hooff JARAM, de Vries HW, Mol JA. 1998. Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs. Applied Animal Behaviour Science 58:365-81.

Behrend EN, Kemppainen RJ, Young DW. 1998. Effect of storage conditions on cortisol, total thyroxine, and free thyroxine concentrations in serum and plasma of dogs. Journal of the American Veterinary Medical Association 212(10):1564-8.

Berger M. 1982. Personality development and temperament. Ciba Foundation Symposium 89:176-90.

Blackshaw JK, Blackshaw AW. 1989. Limitation of salivary and blood cortisol determination in pigs. Veterinary Research Communication 13:265-71.

Bradshaw JWS, Goodwin D. 1998. Determination of behavioural traits of pure-bred dogs using factor analysis and cluster analysis; a comparison of studies in the US and UK. Research in Veterinary Science 66:73-6.

Bradshaw JWS, Goodwin D, Lea AM, Whitehead SL. 1996. A survey of the behavioural characteristics of pure-bred dogs in the United Kingdom. The Veterinary Record 138:465-8.

Campbell SA, Hughes HC, Griffin HE, Landi MS, Mallon FM. 1988. Some effects of limited exercise on purpose-bred Beagles. American Journal of Veterinary Research 49(8):1298-301.

Caraffa-Braga E, Granata L, Pinotti O. 1973. Changes in blood-flow distribution during acute emotional stress in dogs. Pflugers Arch. 339:203-16.

Carlton DL, Richards W. 2002. Affordable noise control in a laboratory animal facility. Lab Animal 31(1):47-8.

Cattell RB, Korth B. 1973. The isolation of temperament dimensions in dogs. Behavioral Biology 9:15-30.

Chapel DD. 2001. Eliminating noise and odor issues. The North American Veterinary ConferenceOrlando, Florida.

Clark JD, Clapin JP, Armstrong RB. 1991. Influence of type of enclosure on exercise fitness of dogs. American Journal of Veterinary Research 52(7):1024-8.

Clark JD, Rager DR, Crowell-Davis S, Evans DL. 1997. Housing and exercise of dogs; effects on behavior, immune function and cortisol concentration. Laboratory Animal Science 47(5):500-10.

Clough G. 1982. Environmental effects on animals used in biomedical research. Biological Review 57:487-523.

Cook NJ, Schaefer AL, Lepage P, Jones SM. 1996. Salivary vs. serum cortisol for the assessment of adrenal activity in swine. Canadian Journal of Animal Science 76:329-35.

Cook NJ, Schaefer AL, Lepage P, Morgan Jones SD. 1997. Radioimmunoassay for cortisol in pig saliva and serum. Journal of the Agricultural Food Chemicals 45:395-9.

Coppinger R, Zuccotti J. 1999. Kennel enrichment: Exercise and socialization of dogs. Journal of Applied Animal Welfare Science 2(4):281-96.

Dess NK, Linwick D, Patterson J, Overmier JB. 1983. Immediate and proactive effects of controllability and predictability on plasma cortisol responses to shocks in dogs. Behavioral Neuroscience 97(6):1005-116.

Dietrich C. 1984. Temperament evaluation of puppies: Use in guide dog selection. Conference for the Human Animal Bond.

Digman JM. 1990. Personality structure: emergence of the five-factor model. Annual Review of Psychology 41:417-40.

Draper TW. 1995. Canine analogs of human personality factors. The Journal of General Psychology 122(3):241-52.

Engeland WC, Miller P, Gann DS. 1990. Pituitary-adrenal and adrenomedullary responses to noise in awake dogs. American Journal of Physiology 258(27):R672-R677.

Falt L, Swenson L, Wilsson E. 1982. Mentalbeskrivning av valpar. Battre Tjanstehundar, Projektrapport II. Statens Hundskola, Sveriges Lantbruksuniversitet and Stockholms Universitet

Feaver J, Mendl M, Bateson P. 1986. A method for rating the individual distinctiveness of domestic cats. Animal Behavior 34:1016-25.

Fell LR, Shutt DA. 1986a. Adrenocortical response of calves to transport stress as measured by salivary cortisol. Canadian Journal of Animal Science 66:637-41.

Fell LR, Shutt DA. 1986b. Use of salivary cortisol as an indicator of stress due to management practices in sheep and cattle. Proc. Aust. Soc. Anim. Prod. 16:203-6.

Fell LR, Shutt DA, Bentley CJ. 1985. Development of a salivary cortisol method for detecting changes in plasma "free" cortisol arising from acute stress in sheep. Australian Veterinary Journal 62(12):403-6.

Fennell LA. 1999. Beyond overpopulation: A comment on Zawistowski et al. and Salman et al. Journal of Applied Animal Welfare Science 2(3):217-28.

Fox MW. 1986. Laboratory Animal Husbandry. Albany, NY: State University of New York Press.

Fox MW. 1972. Socio-ecological implications of individual differences in wolf litters: A developmental and evolutionary perspective. Behaviour 41:298-313.

Fraser D. 1999. Biology of animal stress: implications for animal well-being. Journal of Applied Animal Welfare Science 2(2):157-9.

Friedman SB, Ader R. 1967. Adrenocortical response to novelty and noxious stimulation. Neuroendocrinology 2:209-12.

Fuchs E, Kirschbaum C, Benisch D, Bieser A. 1997. Salivary cortisol; a non-invasive measure of hypothalamo-pituitary-adrenocortical activity in the squirrel monkey, *Samiri sciureus*. Laboratory Animals 31:306-11.

Galosy RA, Clarke LK, Mitchell JH. 1979. Cardiac changes during behavioral stress in dogs. American Journal of Physiology 236(5):H750-H758.

Gamble MR. 1982. Sound and its significance for laboratory animals. Biological Review 57:395-421.

Garnier F, Benoit E, Virat M, Ochoa R, Delatour P. 1990. Adrenal cortical response in clinically normal dogs before and after adaptation to a housing environment. Laboratory Animals 24:40-3.

Goddard ME, Beilharz RG. 1986. Early prediction of adult behavior in potential guide dogs. Applied Animal Behaviour Science 15:247-60.

Goodloe LP. 1996. Issues in description and measurement of temperament in companion dogs. Readings in Companion Animal Behavior. Trenton, NJ: Veterinary Learning Systems. p 32-9.

Goodloe LP, Borchelt PL. 1998. Companion dog temperament traits. Journal of Applied Animal Welfare Science 1(4):303-38.

Gosling JD, John OJ. 1999. Personality dimensions in nonhuman animals: a cross species review. Direct. Psychol. Sci. 8:69-75.

Granata L, Leone D, Paccione F, Rucia D. 1973. Changes in jejunal motility during emotional reactions. Arch. Sci. Biol. 57:87-97.

Groschl M, Biskupek-Sigwart J, Rauh M, Dorr HG. 2000. Measurement of cortisol in saliva using a commercial radioimmunoassay developed for serum. Journal of Laboratory Medicine 24(6/7):314-9.

Gue M, Fioramonti J, Frexinos J, Alvinerie M, Bueno L. 1987. Influence of acoustic stress by noise on gastrointestinal motility in dogs. Digestive Diseases and Sciences 32(12):1411-7.

Haeckel R. 1990. Saliva, an alternative specimen in clinical chemistry. JIFCC 2(5):208-16.

Hanson JD, Larson ME, Snowden CT. 1976. The effects of control over high intensity noise on plasma cortisol levels in rhesus monkeys. Behavior and Biology 16:333-40.

Hart BL, Hart LA. 1985. Selecting pet dogs on the basis of cluster analysis of breed behavior profiles and gender. Journal of the American Veterinary Medical Association 186(11):1181-5.

Hennessy MB. 1997. Hypothalamic-pituitary-adrenal responses to brief social separation. Neuroscience Biobehavior Reviews (21):11-29.

Hennessy MB, Davis HN, Williams MT, Mellott C, Douglas CW. 1997. Plasma cortisol levels of dogs at a county animal shelter. Physiology & Behavior 62(3):485-90.

Hennessy MB, Voith VL, Mazzei SJ, Buttram J, Miller DD, Linden F. 2001. Behavior and cortisol levels of dogs in a public animal shelter, an exploration of the ability of these measures to predict problem behavior after adoption. Applied Animal Behavior Science 73:217-33.

Hennessy MB, Williams MT, Miller DD, Douglas CW, Voith VL. 1998. Influence of male and female petters on plasma cortisol and behaviour: can human interaction reduce the stress of dogs in a public animal shelter? Applied Animal Behaviour Science 61:63-77.

Hetts S, Clark JD, Calpin JP, Arnold CE, Mateo JM. 1992. Influence of housing conditions on beagle behaviour. Applied Animal Behaviour Science 34:137-55.

Hubrecht R. 1994. Dog housing-is there scope for improvement? Federation for European Laboratory Animal Science Associations 1994.

Hubrecht R. 1995b. Dogs and dog housing. Environmental Enrichment Information Resources for Laboratory Animals. p 43-7.

Hubrecht RC. (United Federation for Animal Welfare). 1995c. Comfortable quarters for laboratory dogs. Washington DC: Animal Welfare Institute.

Hubrecht RC. 1993a. A comparison of social and environmental enrichment methods for laboratory housed dogs. Applied Animal Behaviour Science 37:345-61.

Hubrecht RC1993b. Dog housing and welfare. Wheathampstead, Herts UK: Universities Federation for Animal Welfare. 6.

Hubrecht RC. 1995a. Enrichment in puppyhood and its effects on later behavior of dogs. Laboratory Animal Science 45(1):70-5.

Hubrecht RC, Serpell JA, Poole TB. 1992. Correlates of pen size and housing conditions on the behaviour of kennelled dogs. Applied Animal Behaviour Science 34:365-83.

Hughes HC, Campbell S. 1990. Effects of primary enclosure size and human contact. Canine Research Environment: from a Conference held by the Scientists Center for Animal WelfareBethesda, MD.

Hughes HC, Campbell S, Kenney C. 1989. The effects of cage size and pair housing on exercise of Beagle dogs. Laboratory Animal Science 39(4):302-5.

Hughes R, Jones DM. 2001. The intrusiveness of sound: Laboratory findings and their implications for noise abatement. Noise & Health 4(13):51-70.

Humane Society of the United States1981. Description and recommendations for a protoype shelter. Washington DC.

Key D. 2000. Acoustic Measures [Web Page]. Located at: http://www.kenneldesign.com. Accessed 2003 Jul 1.

Kidd AH, Kidd RM, George CC. 1992. Successful and unsuccessful pet adoptions. Psychol Rep 70:547-61.

King SG. Stress Reduction [Web Page]. Located at: http://www.kenneldesign.com. Accessed 2003 Jul 1.

Kirschbaum C, Hellhammer DH. 1999. Noise and stress - salivary cortisol as a non-invasive measure of allostatic load. Noise & Health 4:57-65.

Kirschbaum C, Hellhammer DH. 1989. Salivary cortisol in psychobiological research: an overview. Neuropsychobiology 22:150-69.

Kissebah AH. 1974. 'Stress' hormones and lipid metabolism. Proc. Roy. Soc Med 67:665-7.

Knight JJ. 1967. The hazards of airborne ultrasound. Ultrasonics October:267.

Knol BW. 1989. Influence of stress on the motivation for agonistic behavior in the male dog: role of the hypothalamus pituitary testis system. The Netherlands: Utrecht University . Ph.D. thesis .

Ledger RA, Baxter MR. 1997. The development of a validated test to assess the temperament of dogs in a rescue shelter. Proceedings of the First International Conference on Veterinary Behavioural Medicinep 87-92.

Lester SJ, Bellamy JEC, MacWilliams PS, Feldman EC. 1981. A rapid radioimmunoassay method for the evaluation of plasma cortisol levels and adrenal function in the dog. Journal of the American Animal Hospital Association 17 :121-8.

Liang B, Verrier RL, Melman J, Lown B. 1979. Correlation between circulating catecholamine levels and ventricular vulnerability during psychological stress in conscious dogs. Proceedings of the Society for Experimental Biology and Medicine 161:266-9.

Licht A. 2000. Non-invasive stress parameters in the standardbred. Muenchen: University of Muenchen.

Loveridge GG. 1998. Environmentally enriched dog housing. Applied Animal Behaviour Science 59:101-13.

Lynch JJ, McCarthy JF. 1967. The effect of petting on a classically conditioned emotional response. Behavior Research Therapy 5:55-62.

Mackenzie SA, Oltenacu EAB, Leighton E. 1985. Heritability estimate for temperament scores in German Shepherd dogs and its genetic correlation with hip dysplasia. Behavior Genetics 15(5):475-82.

Mallamud D. 1992. Saliva as a diagnostic fluid. British Medical Journal 305:207-8.

Marks IM. 1986. Genetics of fear and anxiety disorders. British Journal of Psychiatry 149:406-18.

Mason JW. 1968. A review of psychoendocrine research on the pituitary-adrenal cortical system. Psychosm Medicine 30:576-607.

Mather JA, Andersson RC. 1993. Personalities of octopuses. Journal of Comparative Psychology 67:336-40.

McBride EA. 1995. The human-dog relationship. The Waltham Book of Human-Animal Interactions: Benefits and Responsibilities of Pet Ownership. Oxford: Elsevier Science. p 99-112.

McCune S, McPherson JA, Bradshaw JWS. 1995. The Waltham Book of Human -Animal Interactions. Oxford: Pergamon Press. p 71.

Mertens PA, Unshelm J. 1996. Effects of group and individual housing on the behavior of kennelled dogs in animal shelters. Anthrozoos IX(1):40-51.

Meyer HP, Rothuizen J. 1993. Determination of the percentage of free cortisol in plasma in the dog by ultrafiltration/dialysis. Domestic Animal Endocrinology 10(1):45-53.

Miller DD, Staats SR, Partlo C, Rada K. 1996. Factors associated with the decision to surrender a pet to an animal shelter. Journal of the American Veterinary Medical Association 209(4):738-42.

Milligan SR, Sales GD, Khirnykh K. 1993. Sound levels in rooms housing laboratory animals: an uncontrollable daily variable. Physiology and Behavior 53:1067-76.

Muelas MS, Ramirez P, Parrilla P, Ruiz JM, Perez JM, Candel MF, Aguilar J, Carrasco L. 1993. Vagal system involvement in changes in small bowel motility during restraint stress: an experimental study in the dog. British Journal of Surgeons 80(4):479-83.

Muir JL, Pfister HP. 1986. Corticosterone and prolactin responses to predictable and unpredictable novelty stress in rats. Physiology and Behavior 37:285-8.

Muller W. 1987. Effects of excessive noise on man and animals. Animal Production and Environmental Health. Amsterdam: Elsevier. p 40-6.

Neidhart L, Boyd R. 2002. Companion animal adoption study. Journal of Applied Animal Welfare Science 5(3):175-92.

New Jr. JC, Salman MD, Scarlett JM, Kass PH, Vaughn JA, Scherr S, Kelch WJ. 1999. Moving: Characteristics of dogs and cats and those relinquishing them to 12 U. S. animal shelters. Journal of Applied Animal Welfare Science 2(2):83-96.

Newton WM. 1972. An evaluation of the effects of various degrees of long-term confinement of adult Beagle dogs. Laboratory Animal Science 22(6):860-4.

Newton WM. 1978. Environmental impact on laboratory animals. Advances in Veterinary Science and Comparative Medicine 22:128.

Noren O. 1987. Noise from animal production. Animal Production and Environmental Health. Amsterdam : Elsevier. p 27-39.

Novak MA, Drewsen KH. 1989. Enriching the lives of captive primates: issues and problems. Housing Care and Psychological Well-Being of Captive and Laboratory Primates. Park Ridge, NJ: Noyes. p 161-85.

Ottewill D. 1968. Planning and design of accommodation for experimental dogs and cats. Laboratory Animal Symposium 1:97-112.

Overall K. 1994. Temperament testing and training: do they prevent behavioral problems? Canine Practice 19(4):19-21.

Parrott RF, Mission BH, Baldwin BA. 1989. Salivary cortisol in pigs following adrenocorticotrophic hormone stimulation: comparison with plasma levels. British Veterinary Journal 145(4):362-5.

Parrott RF, Misson BH. 1989. Changes in pig salivary cortisol in response to transport stimulation, food and water deprivation, and mixing. British Veterinary Journal 145(6):501-5.

Patronek GJ, Glickman LT, Beck AM, McCabe GP, Ecker C. 1996. Risk factors for relinquishment of dogs to an animal shelter. Journal of the American Veterinary Medical Association 209(3):572-81.

Peterson EA. 1980. Noise and laboratory animals. Laboratory Animal Science 30(2):422-39.

Pfaffenberger CJ, Scott JP, Fuller JL, Ginsburg BE, Bielfelt SW. 1976. Guide Dogs For the Blind: Their Selection, Development and Training. Amsterdam: Elsevier.

Pfleiderer-Hogner M. 1979. Moglichkeiten der Zuchtwentschatzung beim deutschen Schaferhun an Hand der Schutzhundprufung ILudwig-Maximilians-Universitat. Doctoral thesis .

Posage JM, Bartlett PC, Thomas DK. 1998. Determining factors for successful adoption of dogs from an animal shelter. Journal of the American Veterinary Medical Association 213(4):478-82.

Reimers TJ, Lawler DF, Sutaria PM, Correa MT, Erb HN. 1990. Effects of age, sex, and body size on serum concentrations of thyroid and adrenocortical hormones in dogs. American Journal of Veterinary Research 51(3):454-7.

Reimers TJ, Mummery LK, McCann JP, Cowan RG, Concannon PW . 1984. Effects of reproductive state on concentrations of thyroxine 3,5,3' - Triiodothyronine and cortisol in serum of dogs . Biology of Reproduction 31:148-54.

Reuterwall C, Ryman N. 1973. An estimate of the magnitude of additive genetic variation and some mental characters in Alsatian dogs. Hereditas 73:277-83.

Rollin BE. 1991. Social ethics, veterinary medicine, and the pet overpopulation problem. Journal of the American Veterinary Medical Association 198:1153-6.

Rosberg S, Olausson A. 1976. Skatningar av genetiska och fenotypiska parametrar for 60-dagarsvikt, hoftledysplasi och mentaltestvarde hos schafer baserat pa material fran Forsvarets Hundskola.

Rosenthal C. 1999. An adopter's guide to temperament testing animals. American Humane Association 17(3):11-2.

Rothuizen J, Reul JMHM, van Sluijs FJ, Mol JA, Rijnberk A, de Kloet ER. 1993. Increased neuroendocrine reactivity and decreased brain mineralocorticoid receptor-binding capacity in aged dogs. Endocrinology 132(1):161-8.

Ruefenacht S, Gebhardt-Henrich S, Miyake T, Gaillard C. 2002. A behaviour test on German Shepherd dogs: heritability of seven different traits. Applied Animal Behaviour Science 79:113-32.

Sales G, Hubrecht R, Peyvandi A, Milligan S, Shield B. 1997. Noise in dog kennelling: Is barking a welfare problem for dogs? Applied Animal Behaviour Science 52:321-9.

Sales GD, Milligan SR, Khirnykh K. 1999. Sources of sound in the laboratory animal environment: a survey of the sounds produced by procedures and equipment. Animal Welfare 8:97-115.

Sales GD, Wilson KJ, Spencer KEV, Milligan SR. 1988. Environmental ultrasound in laboratories and animal houses: a possible cause for concern in the welfare and use of laboratory animals. Laboratory Animals

22:369-75.

Sales G, Hubrecht r, Peyvandi A, Milligan S, Shield B1996. Noise in dog kennelling: A survey of noise levels and the causes of noise in animal shelters, training establishments and research institutions. Wheathampstead, Herts UK : Universities Federation for Animal Welfare . 9.

Sales GD, Milligan SR, Khirnykh K. 1993. The acoustic environment and its effects on laboratory animals. Fifth FELASA Symposium: Welfare and Science :60-4.

Salman MoD, New JG, Scarlett JM, Kass PH, Ruch-Gallie R, Hetts S. 1998. Human and animal factors related to the relinquishment of dogs and cats in 12 selected animal shelters in the United States. Journal of Applied Animal Welfare Science 1:207-26.

SAS Institute Incorporated. 2002. SAS Version 8 [SAS Version 8]. Version 2002. Cary, NC.

Scarlett JM, Salman MD, New Jr. JG, Kass PH. 1999. Reasons for relinquishment of companion animals in U. S. animal shelters: Selected health and personal issues. Journal of Applied Animal Welfare Science 2(1):41-57.

Schilder MBH. 1992. Stress and welfare and its parameters in dogs. Tijdschrift Voor Diergeneeskunde 117:53S-4S.

Schwizgebel D. 1982. Zusammenhange zwischen dem Verhalten des Tierlehrers und dem Verhalten des Deutschen Schsferhundes im Hinblick auf tiergerechte Ausbildung. Aktuel. Arbeit. Artgemass. Tierhaltung, pp.138-148

Seligman MEP. 1975. Helplessness: on depression, development and death. San Francisco: W. H. Freeman.

Senn CL, Lewin JD. 1975. Barking dogs as an environmental problem. Journal of the American Veterinary Medical Association 166(11):1065-8.

Serpell. James A., Hsu Y. 2001. Development and validation of a novel method for evaluating behavior and temperament in guide dogs. Applied Animal Behaviour Science 72:347-64.

Shirtcliff EA, Granger DA, Schwartz E, Curran MJ. 2001. Use of salivary biomarkers in biobehavioral research: cotton-based sample collection methods can interfere with salivary immunoassay results. Psychoneuroendocrinology 26:165-73.

Spreng M. 2000. Possible health effects of noise induced cortisol increase. Noise & Health 7:59-63.

Stephens DB. 1980. Stress and its measurement in domestic animals: A review of behavioral and physiological studies under field and laboratory conditions. Advances in Veterinary Science and Comparative Medicine 24:179-210.

Sternberg S. 1998. For better or worse. . . Behavioral and emotional managment of long term shelter dogs. Accord, NY: Sue Sternberg.

Sternberg S. 2002. Great dog adoptions: Aguide for shelters. Alameda, CA: Latham Foundation.

Stevenson-Hinde J, Stillwell-Barnes R, Zunz M. 1980. Subjective assessment of rhesus monkeys over successive years. Primates 21:66-82.

Stur I. 1987. Genetic aspects of temperament and behaviour in dogs. The Journal of Small Animal Practice 28(11):957-64.

Svartberg K, Forkman B. 2002. Personality traits in the domestic dog (*Canis familiaris*). Applied Animal Behaviour Science 79:133-55.

Tuber DS, Miller DD, Caris KA, Halter R, Linden F, Hennessy MB. 1999. Dogs in animal shelters: problems, suggestions and needed expertise. Psychological Science 10(5):379-86.

Tunn S, Mollmann H, Barth J, Derendorf H, Krieg M. 1992. Simultaneous measurement of cortisol in serum and saliva after different forms of cortisol administration. Clinical Chemistry 38(8):1491-4.

Tupes EC, Cristal RE. 1992. Recurrent personality factors based on trait ratings. Journal of Personality 60:225-51.

van der Borg JAM, Netto WJ, Planta DJU. 1991. Behavioural testing of dogs in animal shelters to predict problem behaviour. Applied Animal Behaviour Science 32:237-51.

Van Heerden J, Bertschinger HJ. 1982. Serum cortisol concentrations in captive tamed and untamed black-backed jackals (*Canis mesomelas*) and translocated dogs. Journal of South African Veterinary Association 53(4):235-7.

Vincent IC, Leahy RA. 1997. Real-time non-invasive measurement of heart rate in working dogs: a technique with potential applications in the objective assessment of welfare problems. The Veterinary Journal 153:179-84.

Vincent IC, Michell AR. 1992a. Comparison of cortisol concentrations in saliva and plasma of dogs. Research in Veterinary Science 53:342-5.

Vincent IC, Mitchell AR. 1992. Potential applications for non-invasive measurements in small animal epidemology and in the detection of stress. Society for Veterinary Epidemiology and Preventive Medicine.

Vincent IC, Mitchell AR. 1996. Relationship between blood pressure and stress-prone temperature in dogs. Physiology & Behavior 60(1):135-8.

Walker RF, Joyce BG, Dyas J. 1984. Salivary cortisol: 1. Monitoring changes in normal adrenal activity. Immunoassays of steroids in saliva. Cardiff: Alpha Omega. p 308-16.

Website. List of suggestions for a better dog kennel [Web Page]. Located at: http://www3.telus.net/cac/kennels. Accessed 2003 Jul 1.

Wei BL. 1969. Physiological effects of audible sound: AAAS Symposium. Science 166(3904):533-5.

Wells DL, Hepper PG. 2000. The influence of environmental change on the behaviour of sheltered dogs. Applied Animal Behaviour Science 68:151-62.

Widmaier EP, Kunz TH. 1993. Basal, diurnal and stress-induced levels of glucose and glucocorticoids in captive bats. The Journal of Experimental Zoology 265:533-40.

Willis MB. 1987. Breeding dogs for desirable traits. The Journal of Small Animal Practice 28(11):965-83.

Wilson DS, Coleman K, Clark AB, Biederman L. 1993. Shy-bold continuum in pumpkinseed sunfish (*lepomis gibbosus*): an ecological study of a psychological trait. Journal of Comparative Psychology 107:250-60.

Wolfe TL. 1990. Policy, program and people: the three P's to well-being. Scientists Center for Animal Welfare . Canine Research EnvironmentBethesda, MD. Bethesda, MD: Scientists Center for Animal Welfare.

Woods JE, Besch EL. 1974. Influence of group size on heat dissipation from dogs in a controlled environment. Laboratory Animal Science 24:72-8.

Zasshi KH. 1983. Diurnal variation of plasma cortisol and corticosterone in dogs. Japanese Journal of Animal Reproduction 29(2):99-102.

APPENDIX I: AKC Dog Breed Types

American Kennel Club (AKC) dog breed types

Sporting	
Golden Retriever	Brittany Spaniel
Labrador Retriever	Clumber Spaniel
Curly-Coated Retriever	Field Spaniel
Flat-Coated Retriever	English Water Spaniel
Chesapeake Bay Retriever	Irish Water Spaniel
English Setter	American Water Spaniel
Irish Setter	German Short-Haired Pointer
Gordon Setter	Wire-Haired Pointing Griffon
Cocker Spaniel	Weimaraner
Sussex Spaniel	Vizsla

Working	
Alaskan Malamute	Boxer
Akita	Doberman Pinscher
Siberian Husky	Great Dane
Bernese Mountain Dog	Standard Schnauzer
Portuguese Water Dog	Giant Schnauzer
Saint Bernard	Newfoundland
Great Pyrenees	Samoyed
Rottweiler	Komondor
Mastiff	Kuvasz

Non-Sporting	
Bichon Frise	Poodle
Boston Terrier	Dalmatian
French Bulldog	Finnish Spitz
Tibetan Terrier	Chow Chow
Tibetan Spaniel	Lhasa Apso
Keeshond	Chinese Shar-Pei
Schipperke	Bulldog

Herding	
German Shepherd	Cardigan Welsh Corgi
Australian Shepherd	Pembroke Welsh Corgi
Australian Cattle Dog	Belgian Malinois
Old English Sheepdog	Belgian Tervuren
Shetland Sheepdog	Vouvier des Flanders
Belgian Sheepdog	Briard
Collie	Puli
Bearded Collie	

Hounds	
Whippet	Bloodhound
Greyhound	Dachshund
Pharaoh Hound	Beagle
Ibizan Hound	Bassett
Otterhound	Petite Basset Griffon Vendeen
Black and Tan Coonhound	Afghan
Norwegian Elk Hound	Basenji
Scottish Deerhound	Borzoi
Irish Wolf Hound	Harrier
American Fox Hound	Rhodesian Ridgeback
English Fox Hound	Saluki

Terriers	
American Staffordshire Terrier	Miniature Bull Terrier
Australian Terrier	Miniature Schnauzer
Airedale Terrier	Norfolk Terrier
Bull Terrier	Norwich Terrier
Border Terrier	Staffordshire Bull Terrier
Bedlington Terrier	Sealyham Terrier
Cairn Terrier	Soft-Coated Wheaton Terrier
Dandie Dinmont Terrier	Smooth Fox Terrier
Irish Terrier	Scottish Terrier
Kerry Blue Terrier	Skye Terrier
Lakeland Terrier	Welsh Terrier
Manchester Terrier	West Highland White Terrier

Toys	
Silky Terrier	Chihuahua
Yorkshire Terrier	Chinese Crested
Toy Manchester Terrier	Japanese Chin
Toy Poodle	Shih Tzu
English Toy Spaniel	Affepinscher
Pug	Miniature Pinscher
Papillon	Maltese
Pomeranian	Italian Greyhound
Pekingese	Brussels Griffon

APPENDIX II: Description of Temperament Assessment Tasks

The temperament assessment was conducted on day 2 (day 1 = day dog arrived) for each animal assigned to the treatment group. The time required to complete each individual assessment ranged from 30 minutes to 90 minutes.

Task 1: 1st approach – stand neutrally and look at

Approach the kennel without speaking, stand approximately 2-3 feet away and look at the dog.

	Response:	***Description:***
a)	Cower	head or body in a crouching posture
	Sit/stand - calm	sitting or standing calmly
	Sit/stand - nervous	sitting or standing while trembling
	Pace	walking back and forth or in a circle
	Jump	jumping on the door or walls
b)	Approaches and stands	comes to the door and stands still
	Approaches and solicits	comes to the door and solicits attention
	Backs off	retreats or remains in the rear section of the kennel

Task 2: Stand outside and encourage to come to front gate

While standing outside the kennel, call the dog to the front gate using endearing pet names and "kisses"

	Response:	***Description:***
a)	Cower	head or body in a crouching posture
	Sit/stand - calm	sitting or standing calmly
	Sit/stand - nervous	sitting or standing while trembling
	Pace	walking back and forth or in a circle
	Jump	jumping on the door or walls
b)	Approach - connect	comes to the door and makes eye contact
	Approach - no connect	comes to the door but no eye contact
	Lunges/barks	lunges towards the door or barks at tester

Task 3: Bend down and talk to

Bend down at the front of the gate and talk encouragingly to the dog

	Response:	***Description:***
a)	Cower	head or body in a crouching posture
	Sit/stand - calm	sitting or standing calmly
	Sit/stand - nervous	sitting or standing while trembling
	Pace	walking back and forth or in a circle
	Jump	jumping on the door or walls

b)	Approach - connect	comes to the door and makes eye contact
	Approach - no connect	comes to the door but no eye contact
	Approach - wary	comes to the door but shifty/timid eye contact
	Lunges/barks	lunges towards the door or barks at tester

Task 4: Move fingers to another area of kennel

While talking to the dog, place fingers on the chain link so the dog can smell/lick them, then move your hand to various places on the gate

Response:	***Description:***
Follows & contact	follows tester's fingers and maintains contact
Follows & distracted	follows tester's fingers but breaks contact
Doesn't follow	does not follow

Task 5: Enter kennel – reaction to person (licking behavior was noted)

Enter the kennel matter of factly

Response:	***Description:***
Backs away	moves away from the tester
Sits/stands	sits or stands and looks at the tester
Jumps	jumps on the tester/walls or door

Task 6: Placement of collar – resistance

Ask the dog to sit, pet the dog around the face and behind the ears and then gently clasp the collar around the dog's neck.

Response:	***Description:***
None	no hesitation or resistance
Some	some movement away from the collar
Lots	evades the tester
Very	runs away, bites or growls

Task 7: Leaving kennel

Ask the dog to sit, while you open the door and then walk out calmly

Response:	***Description:***
Drag	tester has to drag dog from the kennel
Hesitant	slow and wary when leaving
Heal	walks out nicely with slack in the leash
Eager	walks out quickly
Bolt	dog bolts out once the door is open

Task 8: Walking to enclosure

Start by asking the dog to heal, then let the dog walk as freely as possible

Response:	***Description:***
Drag	tester has to drag dog on leash
Hesitant	slow and wary while walking
Heal	walks nicely with slack in the leash
Eager	walks at the end of the leash
Pulling	while walking is pulling on the leash

Task 9: Free play

Response:	***Description:***
Scared	Does not explore and is trembling
Anxious	explores cautiously
Curious	explores entire area
Excited	runs around excitedly
Aloof	oblivious but not scared

Task 10: Treats offered

Ask the dog to sit and then have him take the treat from your hand

Response:	***Description:***
Hesitantly	takes treat cautiously
Nicely	teeth do not touch skin
Excitedly	teeth touch skin but do not bite
Aggressively	bites treat out of hand
Not interested	does not take treat

Task 11: Back stroking – stroke slow and deep from withers to base of tail

While the dog is standing, stroke his back from withers to the base of his tail using firm, even pressure – repeat three times with a 3-5 second pause between each

Response:	***Description:***
a) During →	
Relaxes	body relaxes
Almost relaxes	body slightly relaxes
Freezes	body freezes
Agitated/aggressive	snaps, growls or moves away
b) Between →	
Moves closer	moves body or head closer
Neutral	does not move
Moves away	moves body or head away
c) After →	
Moves closer	moves body or head closer
Neutral	does not move
Moves away	moves body or head away

Task 12: Head pat – lightly and rapidly 3 times – no talking

Without talking to the dog, pat his head lightly and rapidly three times. Repeat three times with a 3-5 second pause between each

Response:	***Description:***
a) During ➔	
Looks at you	makes eye contact
Neutral	does not move
Hand-shy	squints or flinches
Moves away	moves body or head away
Excited	jumps around or on the tester
Agitated	snaps, growls or moves away
b) Between ➔	
Moves closer	moves body or head closer
Neutral	does not move
Moves away	moves body or head away
c) After ➔	
Moves closer	moves body or head closer
Neutral	does not move
Moves away	moves body or head away

Task 13: Hands-on all over (pinch toes, hold tail)

While talking to the dog, feel around his ears, eyes, nose and mouth. Then feel his legs, neck, stomach, back and tail. Pinch between his toes lightly three times and hold his tail out for 3 seconds

Response:	***Description:***
a) Aggression ➔	
None	no hard looks, growling, snarling or biting
Some	hard look
Lots	hard look and bite/snarl or growl
Very	hard look, bite, snarl and grow
b) Fear ➔	
None	no trembling, crying or biting
Some	trembling or moving away
Lots	trembling and urinating or moving away
Very	trembling, urinating, biting and moving away
c) Excited ➔	
None	no jumping, barking or playing
Some	playing or jumping
Lots	playing and jumping
Very	playing, jumping and barking

Task 14: Play (toys, chase, ball)

Ask the dog to play with stuffed animals, chase/retrieve a ball, wrestle and play tag with tester

Response:	***Description:***

a) People ➔

None	oblivious to play initiation
Some	mild interaction
Lots	play bow, jumping
Very	play bow, jumping, chase and barking

b) Toys ➔

None	no interest in toy
Some	investigates toy
Lots	carries toy or retrieves it
Very	tug of war, shake and throw toy

Task 15: Stomp over to and yell

While the dog is distracted, stomp your feet while moving towards him, clap your hands and yell "hey!" then call the dog back encouragingly

Response:		***Description:***
a)	Scared	freezes and trembles
	Anxious	low posture, submissive or fearful eyes
	Curious	cocks head, eye contact
	Excited	runs toward or away in playful manner
	Aggressive	growls or snarls
	Aloof	no response

b) Called back ➔

Stay away	does not return when called
Come back slowly	returns but hesitantly
Come back quickly	quickly returns
Never left	never left when yelled toward

Task 16: Basic Commands (sit, lay down, paw, come, down-stay)

Ask the dog to sit, lie down, shake, come, stay, roll over and speak

Response:	***Description:***
None	no acknowledgment of any commands
Some	acknowledges less than 3 commands
Lots	acknowledges 4-5 commands
Very	acknowledges more than 5 commands

Task 17: Socialization w/unfamiliar dog (male or female)

After the dog has been outside the kennel for >5 minutes bring another unfamiliar dog to the outside enclosure. With both dogs on leash, introduce them, if there are no altercations; let the testing dog off leash, if still no altercations let the unfamiliar dog off leash, watch them intently for 5-10 minutes

Response:	***Description:***
a) Play ➔	
None	oblivious to other dog
Some	investigates and engages in movement

Lots	play bow, run toward or follow
Very	wrestling, chase, many play bows, barking

b) Aggression →

None	no responses
Some	hackles raised
Lots	hackles, growling
Very	hackles, snarling, growling, biting

c) Dominance →

None	no responses
Some	hackles raised, erect ears
Lots	hackles, snarling, erect ears, direct eye contact
Very	hackles, snarling, discipline towards other dog

d) Submission →

None	no responses
Some	low posture
Lots	low posture, rolling over, tucked tail
Very	low posture, tucked tail, rolling over, urinating, hiding

Task 18: Walk to test room

Start by asking the dog to heal, then let the dog walk as freely as possible

Response:	***Description:***
Drag	tester has to drag dog on leash
Hesitant	slow and wary while walking
Heal	walks nicely with slack in the leash
Eager	walks at the end of the leash
Pulling	while walking dog is pulling on the leash

Task 19: Exploration of room - Curiosity

While remaining in the room but not interacting with the dog, observe behavior (unfamiliar room (7'x7') with toys, treats and a bowl of water on the floor)

Response:	***Description:***
None	does not explore room
Some	walks around room once
Lots	investigates room, toys, bag
Very	investigates room toys and bag, jumps on wall, door, sniffs walls, floor and door

Task 20: Left alone in room - Anxiety

Leave the dog in the room for up to 7 minutes and observe behavior through the door window and with a video camera

Response:	***Description:***

None	sits or lies down, investigates bag, toy, treats
Some	looks at door
Lots	paces, looks at door or lies in front of door
Very	jumps on door, whines, cries, paces

Observations: Any notable behaviors were recorded

Task 21: Sit on floor (30 – 60 seconds)

Upon returning to the room, greet the dog excitedly and sit on the floor

Response:		***Description:***
a)	Aloof	oblivious to tester but not distracted
	Eye contact	looks at tester
	Physical contact	sits on tester, lies touching, paws at
	Distracted	pre-occupied with something else (door, water, toys, etc.)
b)	Stares at door	stares at door
	Sits with	sits or lies touching tester
	Sits away	sits or lies down not touching tester
	Distracted	pre-occupied with something else (door, water, toys)

Task 22: Play in room

Play in the room with stuffed animals, balls and treats

Response:	***Description:***
a) People ➔	
None	no response to tester
Some	mildly responsive
Lots	play bow, tug of war
Very	play bow, tug of war, jumping, barking
b) Toys ➔	
None	oblivious to toys
Some	investigates toys
Lots	throws, shakes, retrieves or chases toys
Very	throws, shakes, retrieves and chases toys

Task 23: Roll dog over

Ask the dog to sit, then lay down and gently roll the dog on its side placing gentle but firm pressure on its shoulders and back legs – hold for 3-5 seconds

Response:	***Description:***
a) During ➔	
Relaxed	body is relaxed and willing
Tolerant	compliant

Struggles-settles	body is tense and some resistance but complies
Tense	body is tense
Struggles	struggles and does not comply
Growls	growls, snarls or snaps

b) After ➔

Relaxed	remains lying down
Appeases	low posture
Neutral	sits or stands up calmly
Excited	jumps up, barks, runs around
Resentful	hard eyes, moves away

Task 24: Safe Hug

While the dog is sitting, face the dog, put his muzzle over your shoulder and gently wrap your arms around his neck – hold for 3-5 seconds

Response:	***Description:***

a) During ➔

Relaxed	body is relaxed and willing
Tolerant	compliant
Struggles - settles	body is tense and some resistance but complies
Tense	body is tense
Struggles	struggles and does not comply
Growls	growls, snarls or snaps

b) After ➔

Relaxed	remains lying down
Appeases	low posture
Neutral	sits or stands up calmly
Excited	jumps up, barks, runs around
Resentful	hard eyes, moves away

Task 25: Reaction to "HEY!!"

While the dog is distracted, yell "hey!" and clap your hands

Response:	***Description:***
Stops and appeases	stops what he is doing and gives submissive postures
Stops and looks	stops what he is doing and looks at tester
Continues and looks	continues what he is doing and looks at tester
Oblivious	is oblivious to tester

Task 26: Reaction to novel objects (remote cars, umbrella, chain)

Observe behaviors while a remote control car is driven around the room and towards the dog and/or between his legs, while an umbrella is opened near his face and when a heavy chain is dropped at his feet onto a concrete floor

Response:	***Description:***
a) Fear →	
None	no responses
Some	move away from quickly
Lots	move away, hide from
Very	move away, hide from and tremble/urinate
b) Aggression →	
None	no responses
Some	try to bite
Lots	bite and growl
Very	bite, growl, snarl and attack
c) Excited →	
None	no responses
Some	bark at
Lots	bark at, play bow
Very	bark at, play bow, jumping

Task 27: Reaction to novel sounds (horns, chain)

Observe behaviors while two different horns are depressed and while a heavy chain is dropped at the dog's feet onto a concrete floor

Response:	***Description:***
a) Fear →	
None	no responses
Some	move away from quickly
Lots	move away, hide from
Very	move away, hide from and tremble/urinate
b) Aggression →	
None	no responses
Some	try to bite
Lots	bite and growl
Very	bite, growl, snarl and attack
c) Excited →	
None	no responses
Some	bark at
Lots	bark at, play bow
Very	bark at, play bow, jumping

Task 28: Walk through cat room - reaction to cats

Walk the dog through the cat room and allow the dog to sniff the front of the cat kennels (careful not to let the dog get scratched)

Response:	***Description:***
None	oblivious to cat presence or mildly curious
Some	looks at and watches their movement
Lots	jumps back from
Very	bark, lunge or try to obtain cat

Task 29: Put back in kennel

While on leash, gently guide the dog back into his kennel

Response:	***Description:***
Scared	trembling/urinating
Hesitant	walking slowly/coaxed in
Walked in	walks calmly in
Forced in	pushed in and door shut strategically

Task 30: Position in kennel 5 minutes later

Without disturbing the dog, check his behavior 5 minutes after he was placed back in the kennel

Response:	***Description:***
Resting & calm	sitting/lying/standing and watching or sleeping
Anxious	pacing or whining
Excited	barking, jumping around
Aggressive	growling, snarling or biting at door

APPENDIX III: FIGURES

Table of Contents

Kennel _____

Name _____

Age _____ Sex _____

Breed(s) _____

Color _____

Tags _____

Intake _____

Ask to have a visit with me!!

Figure 1
Control group (Weld County Humane Society) kennel card

I've been Temperament Tested!!

Kennel 117

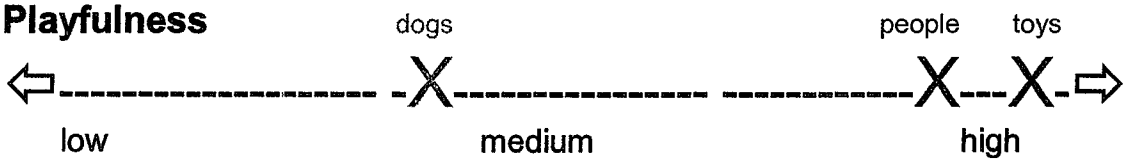
My name is Bo Sex: Male/Neutered

I am an All-American dog and I am 1–1 ½ years old

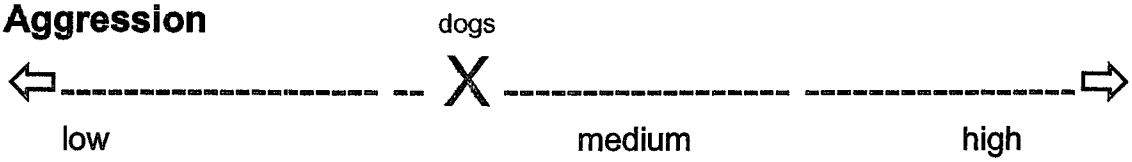
My color/markings are yellow with golden highlights

Intake: 02308 Tags: 19292 Adoptable: 4/12/03

Playfulness



Aggression



Fear/Startle

Separation Anxiety

Obedience

- Lots of energy!
- Loves to play and plays rough
- Needs a lot of exercise
- Doesn't startle easily
- May be dominant with other dogs
- Would do best with an active household without small children

0412149

Figure 2
Example of a treatment group kennel card

What is an All-American Dog?

An All-American dog is a dog that is not a purebred. It is a dog that may have influences from its mother and father from many different breeds. These breed influences may be obvious from physical features but may not be as obvious for temperament and/or personality. An All-American dog is special because it is unique both physically and behaviorally and has immense potential to be a loyal companion and best friend for the right person or family.

Figure 3
Flyer with description of "All-American" term

The dog you have chosen to adopt today has been participating in an adoption success research project conducted by Colorado State University's Animal Sciences Department. The research project investigator is Crista Coppola and she is evaluating the success of temperament testing on adoption success. The purpose of this research is to provide more accurate, precise and applicable information on adoptable adult dogs. The objective is to make a better match between prospective owner and dog in order to improve the animal's well being in its new home and therefore adoption success.

The dog you have chosen was assigned to one of two groups: control or treatment. The control animals have been made available for adoption according to the Weld County Humane Society's normal protocol. The treatment animals have been evaluated through a temperament test to provide more accurate and applicable information on their temperament so that you can make a more educated decision when choosing an animal to adopt. This information has been made available to you in lieu of the standard information provided on breed classification.

The second part of this research involves information obtained from you as the new owner. Your participation in this second part is completely voluntary and all information will be kept confidential. Records will be kept confidential and will be identified by the animal's identification number only. Name and telephone number for the post adoption interview will be used only for contact purposes and will then be destroyed. Information obtained from the survey questions and telephone interview will be compiled and stored according to the animal' s identification number, no human names will be used in the data, only family designations (mother, father, etc.).

Questions will initially be related to your reason for choosing the animal, your expectations of the animal and your previous experience with dogs. The post adoption questions will be related to the temperament of the animal, reason for choosing the animal, the animal's household structure and the accuracy of the temperament test, if applicable. Information requested by you at the time of adoption and six weeks following will be used to validate the results obtained from the temperament tests and to rate the degree of adoption success. Information will be obtained through two short surveys (7 questions or less and approximately 5 minutes each) at the time of adoption and through a telephone interview, consisting of approximately 20 questions (10-15 minutes), six weeks following adoption.

There are no known risks for this procedure. However, it is not possible to identify all potential risks in research procedures and the researcher has taken reasonable safeguards to minimize any known and potential, but unknown, risks.

The benefits of this research include supplying more information on animals so that an appropriate and satisfactory animal can be placed in your new home and identifying any potential behavior problems and ways to possibly prevent them and/or deal with them.

If you are willing to participate in this research you will be asked to sign a consent form. If you have any questions about this research, feel free to ask a staff member or contact Crista Coppola at 970-214-1127.

Figure 4
Recruitment sheet

Colorado State University
Evaluation of the Effect of Temperament Testing of Shelter Dogs on Adoption Success

Dog's ID number_____ Date of adoption _____

PreAdoption Questions

Please answer the following questions to the best of your knowledge. If you need clarification on any question do not hesitate to ask a staff member.

1. What type of dog were you looking for today? (include breed, temperament, activity level, general characteristics)

2. For what purpose or what expectations do you have of your new animal? (where do you see this dog in your household, what role do you expect it to fill)

3. Describe your idea of the perfect animal? (does not have to necessarily be the animal you have chosen to adopt)

4. How long been have you been looking for an animal to adopt?

5. Are there any other animals at home?
   If yes, list what kind and age for each one.

6. What are your reason(s) for wanting a dog? (any dog)

7. Have you owned a dog previously?
   If yes, when and what kind was your most recent? (breed, temperament etc.)

Figure 5
Preadoption questionnaire

Colorado State University
Evaluation of the Effect of Temperament Testing of Shelter Dogs on Adoption Success

Dog's ID number_____ Date of adoption_____

Adoption Questions

Please answer the following questions to the best of your knowledge. If you need clarification on any question do not hesitate to ask a staff member.

1. What type of dog have you chosen to adopt? (general characteristics, temperament)

2. List three (3) key words or phrases you would use to describe **this dog**?

3. Who chose/made the final decision to adopt **this dog**?

4. What was the main reason for choosing **this dog**? (specific to the dog)

5. What was the main reason for choosing this dog **today**? (specific to today)

6. Who will be the primary person responsible for this dog (feeding, walking, training etc.)

If your animal was given a temperament test:

1. How much did the temperament test help you to choose a dog to adopt? (Rate from 1 to 5)

2. Comments about the temperament test (optional)

Figure 6
Adoption questionnaire

COLORADO STATE UNIVERSITY
INFORMED CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

TITLE OF PROJECT: Evaluation of the effect of temperament testing of shelter dogs on adoption success

NAME OF PRINCIPAL INVESTIGATOR: Temple Grandin PhD
NAME OF CO-INVESTIGATOR: Crista Coppola MS
CONTACT NAME AND PHONE NUMBER FOR QUESTIONS/PROBLEMS: Crista Coppola 970-491-6723 or 970-482-3080

PURPOSE OF THE RESEARCH:
The purpose of this research is to provide more accurate, precise and applicable information on adoptable adult dogs. The objective is to make a better match between prospective owner and dog in order to improve the animal's well being in its new home and therefore adoption success.

PROCEDURES/METHODS TO BE USED:
Treatment animals will undergo a temperament test the day after arriving in the shelter. Control animals will not undergo a temperament test. The information obtained from these tests will be made available to prospective owners so that a more informed decision can be made when choosing an appropriate animal. For the treatment and control groups, information provided by the owners at the time of adoption and six weeks following will be used to validate the results obtained from the temperament tests and to rate the degree of adoption success. Information will be obtained through two short surveys (10 question or less and approximately 5 minutes each) at the time of adoption and through a telephone interview, consisting of approximately 20 questions (10-15 minutes), six weeks following adoption. Questions will initially be related to your reason for choosing the animal, your expectations of the animal and your previous experience with dogs. The post adoption questions will be related to the temperament of the animal, reason for choosing the animal, the animal's household structure and the accuracy of the temperament test, if applicable.

RISKS INHERENT IN THE PROCEDURES:
There are no known risks for this procedure
It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

BENEFITS:
The benefits of this research include supplying more information on animals so that an appropriate and satisfactory animal can be placed in a new home and identifying any potential behavior problems and ways to possibly prevent them and/or dealing with them.

CONFIDENTIALITY:
Records will be kept confidential and will be identified by the animal's identification number only. Name and telephone number for the post adoption interview will be used only for contact purposes and will then be destroyed. Information obtained from the survey questions and telephone interview will be compiled and stored according to the animal' s identification number, no human names will be used in the data, only family designations (mother, father etc.).

LIABILITY:
The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

PARTICIPATION:
Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing 1 page.

_____
Participant name (printed)

_____ _____
Participant signature Date

_____ _____
Witness to signature (project staff) Date

Dog ID Number _____

Figure 7
Consent form

Post Adoption Survey Questions
Telephone interview 6 weeks after date of adoption

Date Person calling Interview with

Dog Information
Name (new or kept old from shelter)
Weight Gender (altered)

Status of animal (still have, gave away, ran away etc.)
If no longer have, why?
If behavioral reason, describe/identify behavior.

Primary person responsible for animal

Person animal responds to best

Household structure
Other family members
Other companion animals

Percent of time inside/outside

Amount and type of exercise

Sleeping accommodations (own bed, on furniture etc; where)

Favorite toy(s) if any

Obvious behavior problems (if any)

Satisfied with animal / Met your expectations

Rate the animal as being a good pet for you: 1 to 5 (5 being excellent)

What is dog's best and worst traits?

Knowing what you know now, would you choose this dog for adoption?

If a temperament assessment was given, rate the accuracy of the assessment from 1 to 5 (5 being most accurate)

Any explanations/comments on the assessment

Figure 8
Six-week follow-up interview questions

There is currently a behavior study being conducted jointly by Colorado State University and the Humane Society of Weld County. The purpose of this study is to provide more accurate, precise and applicable information on adoptable adult dogs. The objectives are to make a better match between prospective owner and dog in order to improve the animal's well being in its new home and therefore adoption success and to validate an experimental temperament test.

The dog you chose to adopt (or claim) may have been randomly assigned to one of two groups: control or temperament. The control animals have been made available for adoption according to the Weld County Humane Society's normal protocol and have not been evaluated through a temperament test. The temperament animals have been evaluated through a temperament test to provide more accurate and applicable information on their temperament and/or personality so that you can make a more educated decision when choosing an animal to adopt. This information has been made available in lieu of the standard information provided on breed classification. You can find this information on the animal's kennel window. It is a green sheet that indicates personality traits like playfulness, aggression, fear, obedience etc.

The second part of this study involves information obtained from the new owner (or current owner). Participation in this second part is completely voluntary and all information is kept confidential. Records are kept confidential and are identified by the animal's identification number only. New owners will be asked to fill out a survey at the time of adoption and will be called in 6 weeks to determine adoption success and accuracy of the temperament test (if applicable). Current owners claiming a lost dog that has been temperament tested will be called to determine the accuracy of their dog's temperament test.

The benefits of this study include supplying more information on animals so that an appropriate and satisfactory animal can be placed in a new home and identifying any potential behavior problems and ways to possibly prevent them and/or deal with them.

Please find out if your animal (newly adopted or lost and claimed) has been participating in this important behavior research.

If you are willing to participate in this study you will be asked to sign a consent form. If you have any questions about this study, feel free to ask a staff member or contact Crista Coppola at 970-214-1127.

Figure 9
Study information flyer

What is a Temperament Test?

A temperament test is the observation of an animal while engaged in a series of activities to determine the temperament of that animal. These activities are designed to objectively assess the dog for how he/she would behave in a household environment as a companion animal. This test is not a guarantee of behavior but a prediction of the animal's disposition and how they might react in different situations. The temperament test is designed to make the most information available on an animal up for adoption so that a suitable person may choose him. The temperament test also allows for information that may not otherwise be apparent due to the stressful environment of a shelter and its influence on an animal.

Figure 10
Flyer with explanation of a temperament test

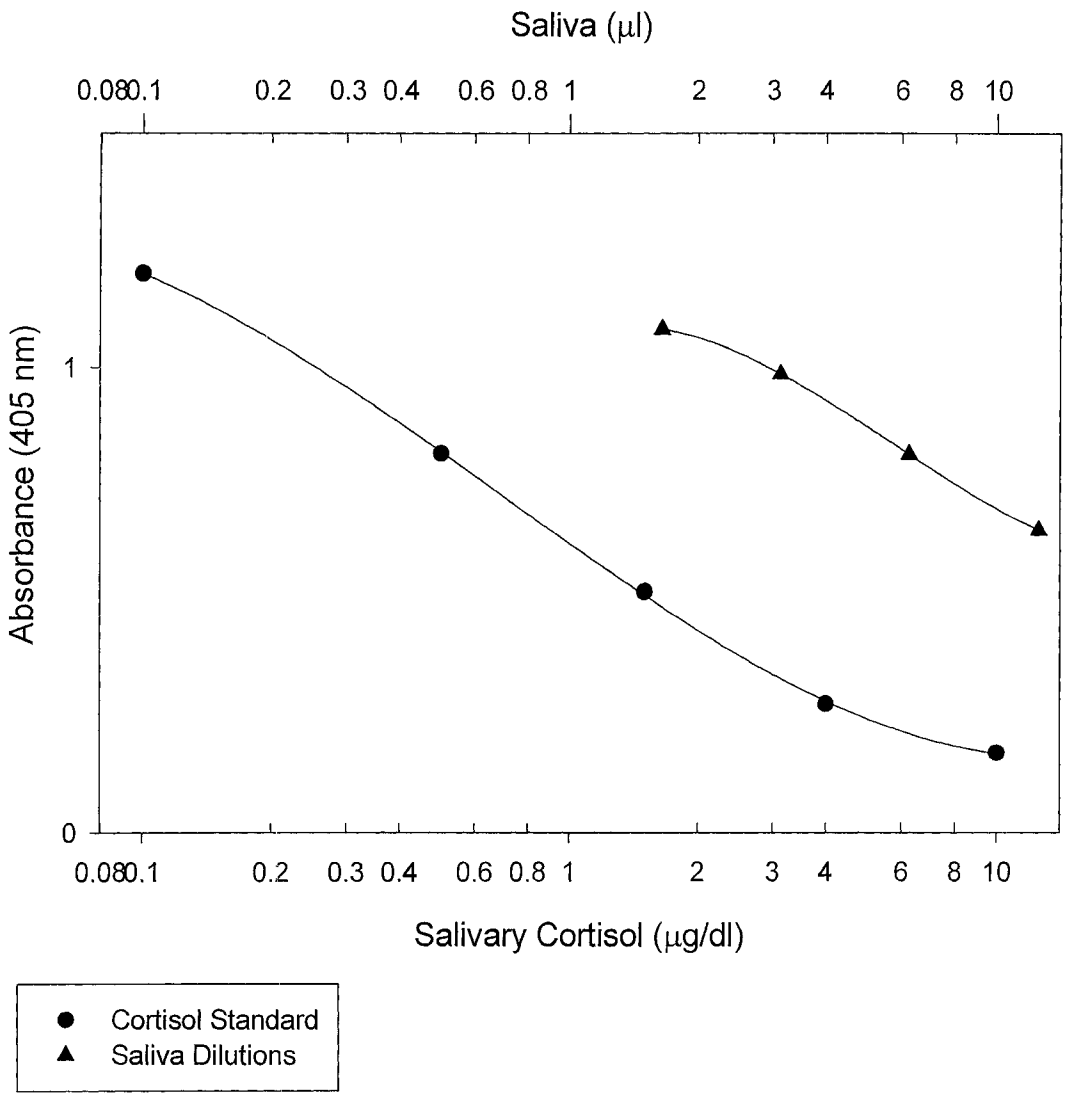


Figure 11
Assay validation test for linearity

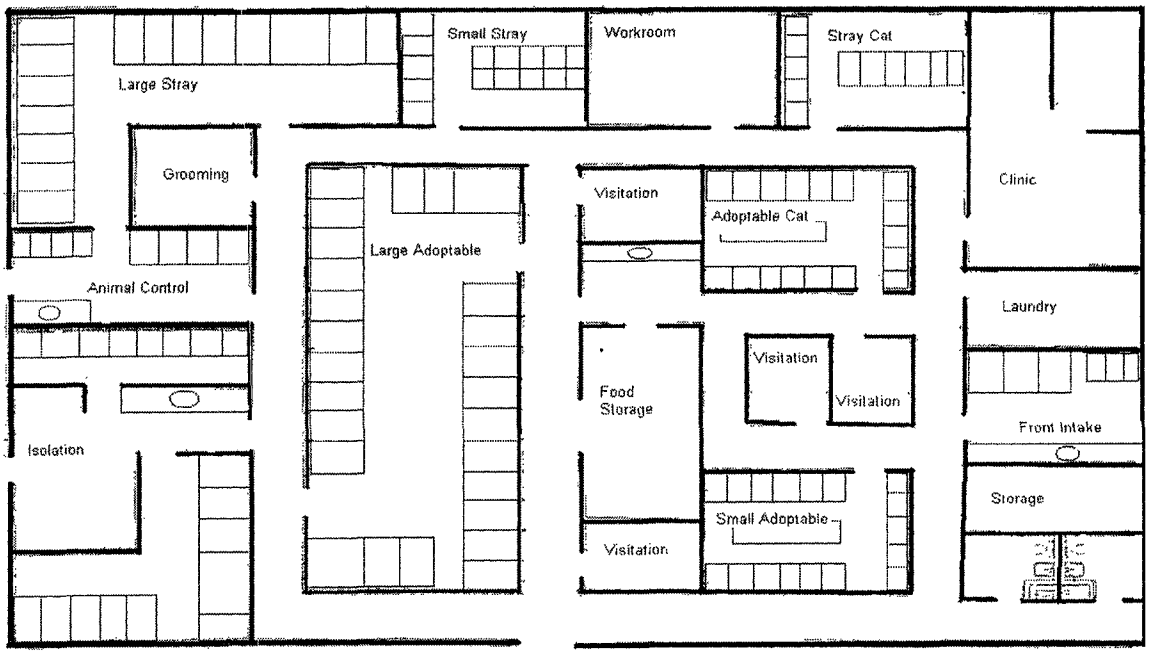


Figure 12
Building diagram of the Weld County Humane Society (66' x 120')