1 **Evaluation of a pheromone collar on canine behaviors during transition from foster homes**
2 **to a training kennel in juvenile Military Working Dogs**

3
4 Desiree Broach, MS, DVM and Arthur Dunham, PhD

5 **Abstract**

6 The purpose of this double-blind, randomized, placebo-controlled study was to determine
7 if the use of a pheromone collar was beneficial in reducing the stress of young Military Working
8 Dogs (MWDs) transitioning from foster care into the training kennel at Lackland Air Force Base,
9 Texas. Although the MWD is bred and trained to be robust and resilient, stark changes in
10 environment and lifestyle can be a shock and lead to deleterious physiological and psychological
11 effects, especially in young developing dogs. To evaluate the potential efficacy and utility of a
12 pheromone collar on the dogs' behaviors during transition, each MWD that returned from foster
13 between October 2014 and February 2015 was randomly assigned to either a placebo or
14 treatment pheromone collar. Collars were worn for 4 weeks. Three behavioral assessments were
15 performed prior to collar placement, then at weeks 3 and 5 of the study, as well as one
16 performance evaluation at week 3. The data were analyzed to determine if use of the pheromone
17 collar had any effect on stress-related behaviors or performance.

18 The results suggest that there was no reduction in observed behavioral signs of stress
19 between the placebo and treatment groups. Further research should focus on a multi-modal
20 approach to mitigation of stressors.

21
22 **Keywords:** Military Working Dog, MWD, pheromone, stress, kennel

Introduction

Military Working Dogs (MWDs) encounter multiple stressors in the working and kennel environment. Kennel stressors include noise (construction, barking dogs, and basic kennel management in environments that reflect sound due to sanitation designs), weather, sanitation procedures, training procedures with varied schedules, and social stressors (e.g., changing numbers and identities of dogs being housed, and interactions with varied staff) (Belpedio, 2010). The Lackland-born juvenile military working dog candidates in this study moved from indoor, private homes, where they were fostered from 6 weeks old to 7 months, to the MWD kennel facility. This move involves exposure to novel environments, people, routines, training, and husbandry practices. The change these dogs experience is essentially “culture shock” which elicits an acute stress response. MWDs have theoretically been bred for resiliency in work environments. Selection has been for behavior and performance in the adult dog that enters training, so the level of the stress response in these MWD candidates may not be as pronounced as in a non-working dog breed or situation. This concept was explored in a study on the baseline salivary cortisol levels in a population of Lackland dogs from 3 stages of training (Broach, unpublished manuscript). The results demonstrated no statistical significant in baseline salivary cortisol between dogs who were untrained, dogs currently in training, and seasoned dogs used as training aids. Responses to prolonged stress to an extreme stressor (e.g., return to kennel at x months) has not been a factor in selection paradigms, yet, differences in coping style can affect the individual’s response to stress, revealing differences in neuroendocrine and behavioral response and adaptability (Koolhaas, et al., 1999). External factors that may also influence the dog’s reactivity and resiliency include maternal stress and post-natal handling. Mild stress of early and daily handling, in a number of species, may prove beneficial to developing resiliency in the stress response, but excessive stress leads to elevated release of ACTH, diminished learning capability, and behavioral problems (Belpedio, 2010; Bisaz & Sandi, 2010; Green, et al., 2011; Lubin, et al., 2008). The amount and types of stress during a dog’s neurobehavioral development, especially during the “socialization period” at 3 to 12 weeks old (Bateson, 1979; Freedman, et al., 1961; Scott & Fuller, 1965), will also affect the individual response.

The type of stimuli and how a puppy is exposed to it during puppyhood has been shown to greatly influence future behavioral responses (Freedman, et al., 1961; Scott & Fuller, 1965). From 3 to 12 weeks puppies undergo sensitive/socialization periods where they are able to learn

social skills, communication skills, and foundational learning (Bateson, 1979; Martin & Martin, 2011). During this period puppies also learn about psychological stress and begin to exhibit fear reactions and postures, startle responses, and reactivity to stimuli such as humans and objects. The puppies whelped by the Department of Defense (DOD) MWD Breeding Program typically stay with their mother and siblings until 6 weeks, at which time they enter private foster homes until 7 months of age. Non-working, pet dogs show significant stress in response to moving to a new home, including excessive vocalization, changes in urination or defecation patterns, over-grooming, and escape attempts (Beaver, 2009; Seksel, et al., 2009). An informal ethogram of the young MWDs at the Lackland AFB kennel showed similar behavioral signs and supports that the juvenile MWDs would likely display evidence of stress (Bryce, et al., Air Force Research Lab, unpublished, 2008).

In military kennels, environmental stressors are mitigated based on a balance of financial cost to animal health and welfare. There are four areas in which stressors can be mitigated: environmental management and enrichment, personnel training and education, behavior modification, and medical intervention (e.g., medication and supplementation). Prescription behavioral medication can be necessary in cases where there is truly a medical or behavioral pathology, regardless of cause, and can enhance patient welfare while facilitating the other areas of mitigation. Supplements can be used to reduce the physical effects of stress when prescription medication may not be warranted. Such interventions include nutritional modification (Kato, et al., 2012), the addition of PUFAs like omega-3 fatty acids (Bauer, 2011), and, possibly the use of pheromonal products (Mills, 2005).

Use of pheromonal products can be relatively inexpensive and does not require the time or compliance of personnel. The synthetic pheromone¹ in the product used for this study has been labeled an “appeasing pheromone”. This pheromone is produced by a female dog from approximately 3 days after she whelps until the puppies are weaned (Pageat & Gaultier, 2003). This pheromone has been reported to reassure puppies during their initial development, and may support learning in puppies and adults when faced with stressful situations (Mills, 2005).

Accordingly, we tested the hypothesis that, in comparison to a placebo collar, the use of a pheromone¹ collar would show a stress-relieving effect in young Belgian Malinois dogs transitioning to military kennel life after approximately 5.5 months in private foster homes. The

¹ Adaptil® Collar, Ceva Animal Health, Inc., Lenexa, KS

hypothesized effect should be apparent in changes in the stress-related behavioral factors assessed, and in increased performance scores. We further hypothesized that were these two effects to be apparent, they would lead to decreased elimination of dogs from the MWD Program.

Materials and Methods

The overall aims of this study were to construct measures to evaluate stress experienced during the transition of MWD puppies into the DOD system after 5.5 months in foster homes, and to use those measures to assess any effect of a synthetic pheromone¹ collar on the transition, using a placebo-controlled, fully blinded study design. All procedures were approved by the Lieutenant Colonel (LTC) Daniel E. Holland MWD Hospital's Institutional Animal Care and Use Committee (IACUC) and granted full approval by the Surgeon General's Office of Research Oversight & Compliance.

All puppies that were whelped at the DOD MWD Breeding Program Kennel, and subsequently returned from foster homes from September 2014 to February 2015, inclusive, were included in the study. Dogs that had a serious pre-existing medical condition prior to return were excluded from the study. Each dog was randomly assigned to the placebo (collar with no synthetic pheromone) or treatment group (collar with synthetic pheromone) for the first 4 weeks of transition to the Lackland AFB Kennel. Placebo collars and a collar randomization chart were provided by Dr. Patrick Pageat at the Institut de Recherche en Semiochimie et Ethologie Applique (iRSEA), which was balanced for each litter, and administered by a third party veterinary technician, ensuring that the study was fully-blinded.

The collar is brown plastic and measures 70cm long by 1.8cm wide. Following manufacturer instructions all collars were fit snugly to the skin and the excess collar trimmed. . The treatment collars contained 5% Canine Appeasing Pheromone analogue, and the placebo collar was simply un-impregnated plastic. All caretakers, evaluators, Puppy Program technicians, and the primary investigator were blind to the collar-type assigned to each subject. All Puppy Program handlers, evaluators, and caretakers were briefed on the protocol and procedures prior to the study start. The initial briefing included information on the pheromone collar uses, hazards and fitting, and study details. At the end of 4 weeks, which is the duration of effectiveness per collar according to the manufacturer literature, the collars were removed by an animal caretaker or veterinary technician.

115 Due to the difference in whelp dates and schedule of MWDs returning from foster homes,
116 the study start and end dates staggered based on the timeline of turn-in. Table 1 shows the
117 estimated study timeline for each litter.

118 Three behavioral assessments and one performance evaluation were conducted the 5-
119 week study period. Each subject had the date of turn-in annotated in his/her veterinary record,
120 which indicated the start of Week 1 of the study for that puppy. At Week 5, the final assessment
121 was performed and study-end annotated in the record. The behavior assessments and
122 performance evaluations were identified as Experiment 1 and 2, respectively.

123 **Experiment 1**-Upon arrival at the Lackland AFB Kennels at the LTC Daniel E. Holland
124 MWD Hospital, the Puppy Program technician and a handler admitted the dog, obtained a
125 weight, annotated a recent patient history from the foster family, and performed an intake
126 physical exam. The Primary Investigator (PI) then fitted the collar. The notes on the medical
127 record progress sheet included the IACUC protocol number, and indicated study participation. A
128 study cover sheet was placed over the Master Problem List (MPL) with the study start and end
129 date for each subject. The PI performed an initial, 5-10 minute observational behavior
130 assessment of the subjects as they were each leash-walked into the exam room by an available
131 handler prior to placement of the collar. The kennel tags for the study participants were
132 uniquely-marked with a strip of blue-tape. This tape clearly identified the dogs as study
133 participants to any personnel interacting with them. Kennel tags were hung in plain sight on the
134 dog's kennel, and were removed and carried by any person removing the dog from his/her
135 kennel.

136 The behavioral assessment evaluated five behavior factors: activity level,
137 aggression/affability, distress, response to handling, and focus (See Appendix A). Each factor
138 was scored using a 5 point Likert scale. A description of the criteria used for each behavioral
139 factor and the criteria used for scoring are listed in Appendix B. Direct observation was used
140 throughout. Each assessment took an average of five to ten minutes per subject. Assessments
141 were not videotaped for additional review due to the lack of additional military raters to review
142 the footage. These decisions prohibited both objective scoring of data and any validation using
143 inter-rater reliability. Dogs were not retested to remove the potentially confounding factor of
144 learning between assessments, which prohibited any measure of intra-rater reliability within
145 dogs.

For the initial assessment, members of the foster family were allowed to be present, but did not handle the dog. A second behavior assessment was performed in the absence of foster family members during Week 3. A final assessment was performed in the same manner as the second assessment during Week 5 (one week after the collar had been removed). Each assessment was annotated in the veterinary record, and all study assessments were kept in a study notebook. At the final assessment, the study end-date was recorded on the subject's record to indicate completion of participation, and the blue-tape strip was removed from the kennel tag.

Behavioral assessments can be difficult to validate and should be combined with history and observation (Bennett, et al., 2012). Among multiple assessments, there lack of standardization, differences in terminology and lack of validation (Diederich & Giffroy, 2006; Haverbeke, et al., 2015; Taylor & Mills, 2006). Progress has been made for validating behavioral tests of dogs in shelter environments (Bennett, et al., 2012; Marder, et al., 2013; Valsecchi, et al, 2011). This study used a combination of performance evaluation, observational behavioral assessment with defined parameters (a benchmarked Likert scale), and a controlled canine population to test for any effect of pheromone treatment on kenneling stress.

Experiment 2- In accordance with the MWD Puppy Program's existing procedures, a 7-month puppy performance evaluation was administered after allowing the MWDs 3-4 weeks to acclimate to the kennel. To standardize this assessment, each litter was scheduled for evaluation 3 weeks after return to the kennel/collar placement. The evaluation consisted of three sections: stability, detection, and patrol testing. One subtest was used for stability, five subtests were used for detection, and five subtests were used for patrol. The subtests and procedures are listed with the full evaluation in Appendix C & D. Some of the subtests were not performed the evaluation process, and those subtests are clearly marked in the Appendix.

Each performance subtest was scored from 1 to 6, with higher scores indicating preferred performance. A sum of the scores from these three tests was used as an overall performance score, and the status of the dog at the end of the study was recorded as "eliminated" or still "in training", although the cut-off for elimination was not based on this sum. The decision to keep or eliminate an individual was based on the metric plus a subjective assessment by training personnel. On the day of testing, the evaluations team retrieved the dogs from their kennel and transported them via an air-conditioned trailer to the testing site. Once at the training site, individual dogs remained in the trailer until their test time. Each dog to be tested was brought

from the trailer to the training site by a handler. One evaluator scored each dog using the evaluation in Appendix C & D. After testing, the dogs were either returned to their kennels or the handlers continued with regular puppy training for that day.

Statistical Analysis. A parametric, Welch two sample t-test was used to evaluate the effect of pheromone treatment on the mean score obtained for each of the five behavioral factors in the behavioral assessments (Activity Level, Focus, Distress, Aggression/Affability, and Response to Handling). T-tests were also used to look for any effect of the pheromonal product on the mean change in score for each of these behavioral factors. Although there is no evidence that the distributions of the response variables violate any of the assumptions of the Welch two-sample t test, because of the relatively small sample sizes we also computed two sided Wilcoxin exact tests on the same data. A G-test was used to evaluate the likelihood that the elimination status of the subject after the performance evaluation was influenced by placebo or treatment group. A power analysis was not performed because baseline data were lacking. There are no published studies for the use of pheromones in MWDs or young Belgian Malinois. Studies using pheromonal products were reviewed and population sizes in these range from 40 to 60 dogs (DePorter, et al., 2012; Kim, et al., 2010; Siracusa, et al., 2010; Taylor & Mills, 2007; Tod, et al., 2005). The sample size for this study was ultimately limited by the number of puppies returning from foster homes during the study period (September 2014-February 2015). All analyses were performed using R statistical software (R Core Team, 2015), and a result was considered significant if $p < 0.05$.

Results

A total of 54 dogs returned to the kennel during the study period; 51 dogs completed the study. Three dogs were eliminated due to medical or scheduling issues (Table 1). There were no statistical differences in the mean score for any of the behavioral factors between the treatment and placebo groups for the behavior assessments (Table 2). This result is the case for both the Welches t -tests and the Wilcoxin exact tests (all $p > 0.05$). Both groups averaged approximately 3.5 for the Distress factor scores, although there appears to be more variability in the treatment group (Figure 1). There were no statistical differences for the change in score between each behavioral factor (Table 2), and the mean change was close to zero for the Distress factor (Figure 2). The change in score was calculated by subtracting the initial behavioral assessment score (baseline) from the final behavioral assessment score for each behavioral factor.

Table 2 shows the mean, Welch t and p-value for each group with respect to the average and change for each behavioral factor. The G-test showed that the treatment and placebo groups did not statistically differ with respect to whether canine dog was retained or eliminated from the MWD program ($C^2 = 1.023$; $p = 3119$, Figure 3). Table 3 shows the performance scores for each subject, identifies the type of collar assigned, and the training status of the subject at the end of the study time period.

Discussion

This study sought to determine whether a commercially available pheromonal product could reduce stress, improve welfare, and produce an overall more robust dog to train as a MWD. Environmental exposure, experience through classical and associative learning, genetics, and epigenetic effects can influence the behavior and work performance of an adult MWD. Many of these effects may be more pronounced in juvenile MWDs that are not fully neurologically developed (Carlson, 2013; Nelson, 2011; Overall, 2013). Chronic exposure to strenuous or stressful stimuli can lead to prolonged activation of the HPA axis, resulting in behavioral disorders, cognitive deficits, and physiologic abnormalities (Dreschel, 2007; Lupien, et al., 1994; Matthews, et al., 2004). Increased reactivity, destructive behavior, fear-related behaviors, and decreased learning are possible ramifications of chronic cortisol elevation (Davis, 1997; Gould & Tanapet, 1999; Green, et al., 2011; Yau, et al., 2002) with detrimental consequences in the performance of a MWD. Identification of measures that can reduce or manage environmental stressors and enhance overall health should have positive effects on learning and subsequent performance. For example, dogs housed with conspecifics spend less time vocalizing and more time investigating the kennel than do singly housed dogs (Belpedio, 2010; Taylor & Mills, 2007). Potentially positive sequelae of reduced stress for MWDs include reduced training attrition rates, improved performance capabilities, and reduced cost of veterinary care for stress-induced ailments. When operating a breeding program, it is essential to maximize each dog's potential to reduce program costs. Evaluation of behavioral traits, alone, are not good predictors of future work performance or certification (Sinn, et al., 2010), so combining stress mitigation tools with behavior and performance assessment is fundamental to improving overall quality of the MWD population.

Pheromones are a type of chemical communication between animals. The physiology of the Vomeronasal Organ (VNO) and pheromone processing is not completely understood, but

what is known is the perception of pheromones is an active process of intake into the VNO, which may be initiated by olfactory, auditory, or visual stimulation (Dulac, 2000; Dulac & Torello, 2003; Leinders-Zufall, et al., 2000; Sam, et al., 2001). This mechanism of detection is different from that of the olfactory system, where smells are perceived passively during the act of respiration (Pageat & Gaultier, 2003) . The appeasing pheromone used for this study is synthetically produced into a commercially available product called Adaptil™, by Ceva Animal Health.

Adaptil™ (formerly referred to as Dog Appeasing Pheromone, or D.A.P.®, until renamed in 2011) has been cited as having various applications for reducing stress or anxiety in dogs (Denenberg & Landsberg, 2008; DePorter, et al., 2012; Graham, et al., 2007; Kim, et al., 2010; Mills, et al., 2006; Sheppard & Mills, 2003; Siracusa, et al., 2010; Taylor & Mills, 2007; Tod, et al., 2005;). However, a systematic review of 14 published articles using pheromonal products reported a lack of sufficient evidence or support of effectiveness in the majority of the articles reviewed (Frank, et al., 2010). Concerns included lack of blinding, lack of controls, incomplete or lack of knowledge on the mechanism of action of the putative pheromonal product, and genuine lack of effectiveness of a synthetic pheromone. No prior work has evaluated the use of such products in young MWDs returning to training kennels after fostering.

The behavioral factors of aggression/affability, distress, response to handling, activity, and focus used in this study were chosen based on characteristics that could be observed during the normal hospital operation and that could be correlated with the overall stress level in the dog. Other behavioral studies have used similar factors for assessment. Because terminology is a concern, we benchmarked our assessments by providing categorical definitional requirements (Diederich & Giffroy, 2006). The standardization between assessments is also lacking; some utilize a variety of Likert scales, others quantify the frequency of specific behaviors, list the responses to a manipulation, or rely on client questionnaires (Diederich & Giffroy, 2006). In human studies, juveniles and adults can articulate their internal emotional state; however, even with an ability to do this, there is large debate about the validity of using personality (or dispositional) traits (Boag, 2015). One argument against the use of personality traits, specifically

Costa and McCrae's Five Factor Model² (FFM) and Goldberg's Big Five³ (BF), relates to the static nature of these models when personality is such a dynamic system and is reflective of environmental influence and not just genetics (Block, 2010). The models do not allow for individual development over time, and each factor is not evaluated in relation to the others (Block, 2010). Another argument is that personality assessments do not account for language or cultural differences, and therefore cannot be considered a universal tool (Chen, et al., 2014; Gurven, et al., 2013; Henrich, et al., 2010). The Canine Behavioural Assessment and Research Questionnaire (C-BARQ) is similar to the human FFM in that it groups individual dogs based on personality factors, such as categories of fear, aggression, or trainability (Serpell & Hsu, 2001). There were 8 factors identified in the 2001 study, which then expanded to 11 factors in 2003; however, only 7 of the 11 factors were deemed validated (Hsu & Serpell, 2003).

The performance evaluation was included not only as a measure of aptitude, but also to potentially identify increased recoverability when exposed to stressors. Temperament tests that have been used in studies of military dogs have been considered selection and performance evaluations rather than determinants of personality factors (Foyer, et al., 2013). Regardless, the tests used also evaluate the response of the canine to stressors, which may indicate the individual's ability to respond and recover from stress. Based on our study, the lack of a significant association between the treatment and any aspect of performance, stress or behavioral assessment is that pheromone exposure in young MWDs does not by reduce distress or enhance performance. This group of military working dog candidates is a unique population, and it is possible that the tests used were not sensitive enough to detect distress of a level that might have been mitigated by the treatment modality.

It's possible that the effects of the commercial pheromonal collar are sufficiently small that the assessments used here would not have detected them. We were unable to concomitantly evaluate physiological measures, such as heart rate, respiratory rate, cortisol level or catecholamine levels, so we can say nothing about potential effects on other measures of stress.

² Costa and McCrae's Five Factor Model-Model that uses factor-analysis to evaluate personality based on Openness, Conscientiousness, Extroversion, Agreeableness, and Neuroticism (Block, 2010).

³ Goldberg's Big Five-Personality model that uses factor-analysis for the traits of Surgency (Extraversion), Agreeableness, Conscientiousness (Dependability), Emotional Stability, and Intellect (Block, 2010).

293 The use of the synthetic pheromone collars for 4 weeks did not significantly reduce
294 distress-related behaviors seen during the transition from foster home to the kennel environment.
295 Multi-modal therapy, such as reduction of environmental stressors (noise mitigation, provide
296 structured enrichment), incorporation of behavior modification through husbandry-related
297 activities (e.g., learning to walk on a leash, wearing a muzzle), and addition of nutritional or
298 pharmaceutical supplements and medications should be evaluated in future studies to evaluate
299 stress reduction in MWDs.

300 **Conclusions**

301 A 4 week use of the synthetic pheromone collars, alone, did not significantly reduce
302 stress-related behavior or improve performance in juvenile MWDs transitioning from a foster
303 home to a training kennel. Research to develop standardized and validated performance and
304 behavioral assessments is needed to accurately assess any response to proposed mitigation
305 techniques so that dogs can be compared across time, facilities, interventions and populations.
306

307
308

APPENDIX A- BEHAVIORAL ASSESSMENT

Study Subject # _____
Subject ID: _____ Control #: _____ Date: _____
Assessment #: _____ Weight: _____ lbs BCS: /9⁴
Sex: _____

Behavior

Activity Level	1 Sedentary	2 Below Average	3 Average	4 Above Average	5 Excessive
Focus	1 Completely Inattentive	2 Mildly Attentive, Easily Distracted	3 Moderately attentive, Not easily distracted	4 Very Attentive, Distracted with effort	5 Completely Attentive
Distress-related	1 Severely Distressed	2 Moderately Distressed	3 Mildly Distressed	4 Relaxed	5 Very Relaxed
Aggression/ Affability	1 Strongly Aggressive	2 Moderately Aggressive	3 Ambivalent	4 Sociable	5 Very Sociable
Response to Handling	1 Intractable	2 Moderate Resistance	3 Mild Resistance	4 Tolerant	5 Very Tolerant

Health Issues? Y/N: _____

Comments: _____

309

⁴ American Animal Hospital Association Body Condition Scoring (BCS) Systems

APPENDIX B- BEHAVIORAL ASSESSMENT

Activity Level	<u>Sedentary</u> - Alert but little to no physical activity. Requires encouragement of activity to get movement onto scale or table to facilitate examination.	<u>Below Average</u> - Bright and alert, mild to moderate physical activity. Sits still on the table or floor without coaxing to settle, but does not require encouragement of activity.	<u>Average</u> - High physical activity, but able to sit still on the table or floor scale, little to no jumping, pacing, rolling. Not likely to require coaxing to settle for examination.	<u>Above Average</u> - Very high physical activity, difficulty sitting still on the exam table or floor scale, may require some coaxing to settle for examination	<u>Excessive</u> - Excessive physical activity, locomotion and movement: pulling at the leash, inability to sit still on exam table and/or floor scale (jumping, spinning, rolling, pacing), may require constant coaxing to settle for examination
Aggression/ Affability	<u>Strongly Aggressive</u> - Does not accept interaction and displays severe signs of defensive aggression toward foster(s), handler(s), and/or vet staff	<u>Moderately Aggressive</u> - Does not accept interaction and displays mild to moderate signs of defensive aggression toward foster(s), handler(s), and/or vet staff	<u>Ambivalent</u> - Does not show interest in or acceptance of interaction from foster(s), handler(s), and/or vet staff	<u>Sociable</u> - Accepts interaction from foster(s), handler(s), and/or vet staff	<u>Very Sociable</u> - Solicits and accepts interaction from foster(s), handler(s), and/or vet staff
Distress	<u>Severely Distressed</u> - Consistent signs of severe agitation or uneasiness (any combination of mild and moderate signs, plus vocalization (growling, snarling), struggling, urination/ defecation, discharge of anal glands, not willing to accept treats, with or without the presence of defensive aggression (biting, snapping)	<u>Moderately Distressed</u> - Consistent signs of moderate agitation or uneasiness (any combination of mild signs, plus displacement behavior ⁵ , piloerection, fidgeting, rolling, excessive movement, lack of movement, showing teeth, hyper-salivation, vocalization (whining, barking), crouched posture, may or may not be willing to accept treats	<u>Mildly Distressed</u> - Consistent mild signs of agitation or uneasiness (Any combination of ears pulled back, lip licking, tail tucked, showing whites of the eyes, dilated pupils, panting, tense muscles/lips), still willing to accept treats	<u>Relaxed</u> -sitting, standing, or lying down with a relatively loose body and few or transient mild signs of agitation or uneasiness, willing to accept treats	<u>Very Relaxed</u> - sitting, standing, or lying down with a loose body and no signs of agitation or uneasiness, willing to accept treats
Response to handling	<u>Intractable</u> - Consistent resistance with any combination of mild or moderate signs plus inability to complete one or more aspects of examination, with or without moderate to severe aggression	<u>Moderate Resistance</u> - Consistent resistance with any combination of mild signs but able to complete all aspects of examination, with or without mild aggression such as growling or showing teeth	<u>Mild Resistance</u> - Consistent mild resistance, such as flinching, pulling away, turning away, or backing up but able to complete all aspects of examination	<u>Tolerant</u> - Allows examination with no resistance or transient mild resistance	<u>Very Tolerant</u> - Allows examination with no resistance
Focus	<u>Completely Inattentive</u> - Does not appear to watch, listen, or attend to any person, object, or stimulus	<u>Mildly Attentive, Easily Distracted</u> - Rarely appears to watch, listen, or attend to the foster(s), handler(s), or vet staff; Consistently attending to other objects or stimuli in the room or through the window.	<u>Moderately Attentive, Not Easily Distracted</u> - Mostly appears to watch, listen, or attend to the foster(s), handler(s), or vet staff; Sometimes attends to other objects or stimuli in the room or through the window.	<u>Very Attentive, Distracted with Effort</u> - Consistently appears to watch listen, or attend to the foster(s), handler(s), or vet staff; Attends to other stimuli or objects only if very pronounced (loud noise, erratic movement)	<u>Completely Attentive</u> - Completely appears to watch listen, or attend to the foster(s), handler(s), or vet staff; Does not attend to other stimuli or objects

⁵ Displacement behavior- exaggeration of a basic behavior being displayed as an outlet for frustration, agitation, or distress.

313
314

APPENDIX C- PERFORMANCE EVALUATION

7 MONTH PUPPY EVALUATION

MWD Procurement Evaluation (ID) Form

Name:	Breed: Belgian Malinois ▼	Other:	Sex: Male ▼
Control/Tattoo #	Vendor:	Returnee: No ▼	Prev Date:
DoB:	DoD: Patrol	Expl	Drug
	Neutral	TSA	SSD
	Other		

STABILITY TESTING:			
A. Walk on leash through building or complex area--stairs, confined spaces, slick floors, noisy objects		Environmental Behavior	Date- Site- Evaluator-
Crate- No ▼ Muzzle- No ▼	Comments:	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6
B. Shoot gun 6 times at successively closer distances to dog.		Gunsureness	Date- Site- Evaluator-
Steady ☐ Excited/overreacting ☐ Aggressive ☐	Comments:	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6

DETECTION TESTING: "ID" Test				Sess 1	Sess 2
Sits- No ▼	KONG ▼	Substance/Odor-	Date- Site- Evaluator- Tester-	Date- Site- Evaluator- Tester-	
Comments:					
A. Tester shows object to dog, places it on ground approx 10 feet from dog, steps away, and watches dog for 15-30 seconds during distraction. Then evaluator throws object and dog allowed to pursue and retrieve		Static Object Interest	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
		Thrown Object Interest	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
B. Dog holds object for 15-30 seconds, without input from handler or tester, then tester attempts to physically take object away (i.e. tug of war). If tester cannot take object, then handler attempts to take it away or "out" dog.		Possession	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
		Physical Possession	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
C. Tester entices dog with object and then pretends to place/throw object while dog watches. Dog allowed to pull forward and search for odor. When dog sniffs the aid, then evaluator throws object in at source. One final response may be required. Exercise repeated three to four times		Active Search /Sniff 1	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
		Static	1 - 2 - 3 - 4 - 5 - 6	1 - 2 - 3 - 4 - 5 - 6	
Date	Sess 3	Trials	Comments:		
Date	Sess 4	Trials	Comments:		
Date	Sess 5	Trials	Comments:		
Date	Sess 6	Trials	Comments:		
Date	Sess 7	Trials	Comments:		
Detection ID 1			Detection ID 2		
Vendor Site	Passed	Failed	Vendor Site	Passed	Failed

315
316

APPENDIX D- PERFORMANCE EVALUATION

PATROL TESTING:			
Comments:		Date- Site- Evaluator- Tester-	Date- Site- Evaluator- Tester-
Defense Test-- Dog held on leash by stranger. Decoy approaches in civil and threatens dog. Decoy pauses for about 5-8 seconds to observe dog's interest, drops whip, then threatens again.	Defense	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
	Threat / Aggression	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Non-Threat Bite-- Decoy walks away and picks up bite sleeve, walks back to dog rather passively, and allows dog to bite. After contact, decoy moves for 3-5 seconds to "set bite," and then freezes in a neutral position and allows the dog to bite for 10-15 seconds.	Non-Threat Bite Quality	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Re-Attract-- Decoy drops sleeve and attempts to re-attract/transfer dog from sleeve. If dog will not release, handler uses collar pressure. Decoy agitates dog for a few moments and attempts to lead dog away from sleeve.	Comments:		
Threat Bite--Decoy recovers sleeve, walks away from dog about 20 feet, turns and walks back at dog while threatening dog with whip, allows dog to bite, then threatens dog and strikes leash sharply twice with the whip.	Threat Bite Quality	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Re-Attract-- Decoy drops sleeve and attempts to re-attract/transfer dog from sleeve as in C	Transfer	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Pursuit Bite-- Decoy runs/walks away about 35-40 yards, picks up a bite sleeve and performs passive walk-away bite. Stops in neutral posture and waits for handler to arrive, providing little stimulation to dog.	Pursuit Bite	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Re-Attract--As in C			
Front Bite-- Decoy walks away about 20 feet, picks up bite sleeve and holds at side. Calls for dog to be sent, walks at dog, and threatens dog with whip prior to bite.	Front Bite	1 -2 -3 -4 -5 -6 ☐	1 -2 -3 -4 -5 -6 ☐
Re-Attract--As in C			
Comments:			
Patrol ID 1 Vendor Site ☐ Passed ☐ Failed ☐		Patrol ID 2 Vendor Site ☐ Passed ☐ Failed ☐	

DETECTION				PATROL			
Vendor Site	Passed ☐	Failed ☐		Vendor Site	Passed ☐	Failed ☐	
Offsite	Passed ☐	Failed ☐		Offsite	Passed ☐	Failed ☐	
Reward	Kong ☐	Ball ☐		MEDICAL	Passed ☐	Failed ☐	
Odor				Reason Failure:			
Selected as:	Patrol/Detector	Detector Only		Patrol Only	TSA	SSD	

Name Evaluator	Signature	Date	Accepted ☐
			Rejected ☐

REFERENCES

- Bateson, P. 1979. How do sensitive periods arise and what are they for? *Anim. Behav.*, 27, 470-486.
- Bauer, J. E. 2011. Therapeutic use of fish oils in companion animals. *J. Am. Vet. Med. Assoc.*, 239, 1441-1451.
- Beaver, B. 2009. *Canine Behavior: Insights and Answers* (Second ed.). St Louis: Elsevier.
- Belpedio, C. 2010. Understanding kennel stress in canines (*Canis lupis familiaris*)- A review of the literature. *J. Appl. Comp. Anim. Behav.*, 4(1), 7-14.
- Bennett, S., Litster, A., Weng, H.-Y., Walker, S., Luescher, A. 2012. Investigating behavior assessment instruments to predict aggression in dogs. *Appl. Anim. Behav. Sci.*, 141(3-4), 139-148.
- Bisaz, R., Sandi, C. 2010. The role of NCAM in auditory fear conditioning and its modulation by stress: a focus on the amygdala. *Genes Brains Behav.*, 9, 353-364.
- Block, J. 2010. The five-factor framing of personality and beyond: some ruminations. *Psychol. Inq.*, 21, 2-25.
- Boag, S. 2015. Personality assessment, 'construct validity', and the significance of theory. *Pers. Individ. Dif.*, 84, 36-44.
- Carlson, N. 2013. *Physiology of Behavior* (Eleventh ed.). Boston: Pearson Education, Inc.
- Chen, S., Benet-Martinez, V., Ng, J. 2014. Does language affect personality perception? A functional approach to testing the Whorfian Hypothesis. *J. Pers.*, 82(2), 130-143.
- Davis, M. 1997. Neurobiology of fear responses: the role of the amygdala. *J. Neuropsychiatry Clin.*, 9, 382-402.
- De Meester, R., Mills, D., De Keuster, T., Schoning, B., Leyvraz, A., Da Graca Pereira, G., Gaultier, E., Corridan, C. 2011. ESVCE position statement on risk assessment. *J. Vet. Behav.*, 6, 248-249.
- Denenberg, S., Landsberg, G. 2008. Effects of dog-appeasing pheromones on anxiety and fear in puppies during training and on long-term socialization. *J. Am. Vet. Med. Assoc.*, 233(12), 1874-1882.
- DePorter, T., Landsberg, G., Beck, A. 2012. Efficacy evaluation of D.A.P.® diffuser versus placebo diffuser for guide dogs completing the final stage of training program leading to graduation as a working guide dog with a visually impaired person. *ACVB/AVSAB Veterinary Behavior Symposium*, (pp. 21-25). San Diego.
- Diederich, C., Giffroy, J.-M. 2006. Behavioural testing in dogs: a review of methodology in search for standardisation. *Appl. Anim. Behav. Sci.*, 97, 51-72.

358 Dreschel, N. A. 2007. The biobehavioral effects of stress related to fear and anxiety in domestic
359 canines. University Park: UMI Dissertations Publishing.

360 Dulac, C. 2000. Sensory coding of pheromone signals in mammals. *Curr. Opinion Neurobiol.*,
361 10, 511-518.

362
363 Dulac, C., Torello, A. 2003. Molecular detection of pheromone signals in mammals: from genes
364 to behaviour. *Nature Rev. Neurosci.*, 4, 551-562.

365
366 Foyer, P., Wilsson, E., Wright, D., & Jensen, P. 2013. Early experiences modulate stress coping
367 in a population of German shepherd dogs. *Appl. Anim. Behav. Sci.*, 146, 79-87.

368 Frank, D., Beauchamp, G., & Palestrini, C. 2010. Systematic review of the use of pheromones
369 for treatment of undesirable behavior in cats and dogs. *J. Am. Vet. Med. Assoc.*, 236(12),
370 1308-1316.

371 Freedman, D., King, J., Elliot, O. 1961. Critical periods in teh social development of dogs.
372 *Science*, 133, 1016-1017.

373
374 Gould, E., Tanapet, P. 1999. Stress and hippocampal neurogenesis. *Biol. Psychiatry*, 46, 1471-
375 1479.

376
377 Graham, D., Mills, D. S., & Bailey, G. 2007. Evaluation of the effect of temporary exposure to
378 synthetic dog appeasing pheromone (DAP) on levels of arousal in puppy classes. *J. Vet.*
379 *Behav.*, 2(3), 90.

380 Green, M., Rani, C., Josh, I., Soto-Pina, A., Martinez, P., Frazer, A., Strong, R., Morilak, D.
381 2011. Prenatal stress induces long term stress vulnerability, compromising stress response
382 systems in the brain and impairing extinction of conditioned fear after adult stress.
383 *Neuroscience*, 192, 438-451.

384
385 Gurven, M., von Rueden, C., Massenkoff, M., Kaplan, H., & Vie, M. L. 2013. How universal is
386 the Big Five? Testing the Five-Factor Model of personality variation among forager-
387 farmers in the Bolivian Amazon. *J. Pers. Soc. Psychol.*, 104(2), 354-370.

388 Haverbeke, A., Pluijmakers, J., & Diederich, C. 2015. Behavioral evaluations of shelter dogs:
389 literature review, perspectives, and follow-up within the European member state's
390 legislation with emphasis on the Belgian situation. *J. Vet. Behav.*, 10(1), 5-11.

391 Henrich, J., Heine, S. J., & Norenzayan, A. 2010. The weirdest people in the world? *Behav.*
392 *Brain Sci.*, 33, 61-135.

393 Hsu, Y., & Serpell, J. A. 2003. Development and validation of a questionnaire for measuring
394 behavior and temperament traits in pet dogs. *J. Am. Vet. Med. Assoc.*, 223(9), 1293-
395 1300.

396 Kato, M., Miyaji, K., Ohtani, N., Ohta, M. 2012. Effects of prescription diet on dealing with
397 stressful situations and performance of anxiety-related behaviors in privately owned
398 anxious dogs. *J. Vet. Behav.*, 7, 21-26.

399
400 Kim, Y.-M., Lee, J.-K., Abd el-aty, A. M., Hwang, S.-H., Lee, J.-H., & Lee, S.-M. 2010.
401 Efficacy of dog-appeasing pheromone (DAP) for ameliorating separation-related
402 behavioral signs in hospitalized dogs. *Can. Vet. J.*, 51, 380-384.

403 Koolhaas, J. M., Korte, S. M., De Boer, S. F., Van Der Vegt, B. J., Van Reenen, C. G., Hopster,
404 H., De Jong, I. C., Ruis, M. A. W., Blokhuis, H. J. 1999. Coping styles in animals:
405 current status in behavior and stress-physiology. *Neurosci. Biobehav. Rev.*, 23, 925-935.

406 Landsberg, G., Hunthausen, W., & Ackerman, L. 2013. *Behavior Problems of the Dog & Cat*
407 (Third ed.). St Louis: Elsevier.

408 Leinders-Zufall, T., Lane, A., Puche, A., Ma, W., Novotny, M., Shipley, M., Zufall, F. 2000.
409 Ultrasensitive pheromone detection by mammalian vomeronasal neurons. *Nature*, 405,
410 792-796.

411
412 Lubin, F., Roth, T., Sweatt, J. 2008. Epigenetic regulation of *dbnf* gene transcription and
413 consolidation of fear memory. *J. Neurosci.*, 28, 10576-10586.

414
415 Lupien, S., Lecours, A. R., Lussier, I., Schwartz, G., Nair, N., & Meaney, M. J. 1994. Basal
416 cortisol levels and cognitive deficits in human aging. *J. Neurosci.*, 15(5), 2893-2903.

417 Martin, K. M., & Martin, D. 2011. *Puppy Start Right: Foundation Training for the Companion*
418 *Dog* (Second ed.). Waltham: Sunshine Books, Inc.

419 Matthews, G., Warm, J. S., & Washburn, D. 2004. Diagnostic methods for predicting
420 performance impairment associated with combat stress. Fort Detrick: U.S. Army Medical
421 Research and Materiel Command.

422 Mills, D., 2005. Pheromonatherapy: theory and applications. *In Pract.*, 27, 368-373.

423 Mills, D. S., Ramos, D., Estelles, M. G., & Hargrave, C. 2006. A triple-blind placebo-controlled
424 investigation into the assessment of the effect of Dog Appeasing Pheromone (DAP) on
425 anxiety related behaviour of problem dogs in the veterinary clinic. *Appl. Anim. Behav.*
426 *Sci.*, 98, 114-126.

427 Nelson, R. J. 2011. *An Introduction to Behavioral Endocrinology* (Fourth ed.). Sunderland:
428 Sinauer Associates, Inc.

429 Overall, K. L. 2013. *Manual of Clinical Behavioral Medicine for Dogs and Cats*. St Louis:
430 Mosby.

431 Pageat, P., & Gaultier, E. 2003. Current research in canine and feline pheromones. *Vet. Clin.*
432 *North Am. Small Anim. Pract.*, 33, 187-211.

433 R Core Team, 2013. *R: A language and environment for statistical computing*. RFoundation for
434 Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL[http://www.R-](http://www.R-project.org/)
435 [project.org/](http://www.R-project.org/).

436

437 Sam, M., Vora, S., Malnic, B., Ma, W., Novotny, M., Buck, L. 2001. Odorants may arouse
438 instinctive behaviours. *Nature*, 412, 142.
439

440 Scott, J., Fuller, J. 1965. *Genetics and the Social Behavior of the Dog*. Chicago: University of
441 Chicago Press.
442

443 Seksel, K., Coyle, K., Chaseling, S. 2009. Stresses associated with moving house with pets. In B.
444 Beaver, *Canine Behavior: Insights and Answers* (p. 142). St Louis : Elsevier.
445

446 Serpell, J. A., & Hsu, Y. 2001. Development and validation of a novel method for evaluating
447 behavior and temperament in guide dogs. *Appl. Anim. Behav. Sci.*, 72(4), 347-364.

448 Sheppard, G., & Mills, D. S. 2003. Evaluation of dog-appeasing pheromone as a potential
449 treatment for dogs fearful of fireworks. *Vet. Rec.*, 432-436.

450 Sinn, D. L., Gosling, S. D., & Hilliard, S. 2010. Personality and performance in military working
451 dogs: Reliability and predictive validity of behavioral tests. *Appl. Anim. Behav. Sci.*,
452 127, 51-65.

453 Siracusa, C., Manteca, X., Cuenca, R., del Mar Alcala, M., Alba, A., Lavin, S., & Pastor, J. 2010.
454 Effect of a synthetic appeasing pheromone on behavioral, neuroendocrine, immune, and
455 acute-phase perioperative stress responses in dogs. *J. Am. Vet. Med. Assoc.*, 237(6), 673-
456 681.

457 Taylor, K. D., & Mills, D. S. 2006. The development and assessment of temperament tests for
458 adult companion dogs. *J. Vet. Behav.*, 1, 94-108.

459 Taylor, K., & Mills, D. S. 2007. A placebo-controlled study to investigate the effect of Dog
460 Appeasing Pheromone and other environmental and management factors on the reports of
461 disturbance and house soiling during the night in recently adopted puppies (*Canis*
462 *familiaris*). *Appl. Anim. Behav. Sci.*, 105, 358-368.

463 Tod, E., Brander, D., & Waran, N. 2005. Efficacy of dog appeasing pheromone in reducing
464 stress and fear related behaviour in shelter dogs. *Appl. Anim. Behav. Sci.*, 93, 295-308.

465 Yau, F., Noble, J., Hibbert, C., Rowe, W., Meaney, M., Morris, R., & Seckl, J. 2002. Chronic
466 treatment with the antidepressant amitriptyline prevents impairments in water maze
467 learning in aging rats. *J. Neurosci.*, 22, 1436-1442.
468

Acknowledgements

Funding of this project was provided through the Department of Defense Military Working Dog Veterinary Services, with donation of the placebo collars by the Institut de Recherche en Semiochimie et Ethologie Applique (iRSEA).

Approval for this research was obtained through the Department of Defense Military Working Dog Veterinary Service's IACUC and the U.S. Air Force Office of Research Oversight and Compliance.

The idea for this paper was conceived by Dr. Desireé Broach. The experiments were designed and performed by Dr. Desireé Broach. The data were analyzed by Dr. Arthur Dunham. The paper was written by Dr. Desireé Broach and Dr. Arthur Dunham.

Table 1

Table 1. Schedule of turn-in and assessment. Two subjects were eliminated for medical reasons prior to turn-in and were not assigned a collar (1-YY Litter, 1-ZZ Litter). One subject from the BB Litter was eliminated due to an unplanned change in foster turn-in that occurred after the study period.

<u>Litter</u> <u>(Whelped)</u>	<u># Subjects</u> <u>(# in</u> <u>Litter)</u>	<u>Placebo/Treatment</u> <u>Collars Assigned</u>	<u>Turn-In &</u> <u>Assessment</u> <u>1</u>	<u>Week of</u> <u>Evaluation &</u> <u>Assessment 2</u>	<u>End of Study &</u> <u>Assessment 3</u>
River (Mar 14)	10 (10)	5/5	10/20/ 2014	11/3/2014	11/17/2014
YY (Apr 14)	8 (9)	4/4	11/24/2014	12/8/2014	12/22/2014
ZZ (May 14)	8 (9)	4/4	12/1/2014	12/15/2014	12/29/2014
AA (May 14)	5 (5)	2/3	12/29/2014	1/12/2015	1/26/2015
DD (Jun 14)	3 (3)	2/1	1/19/2015	2/2/2015	2/16/2015
CC (Jul 14)	5 (5)	2/3	2/2/2015	2/16/2015	3/2/2015
BB (Jul 14)	12 (13)	6/6	2/9/2015	2/23/2015	3/9/2015

Table 2

Table 2. Welch t-test Data Table

Variable	Treatment Mean	Placebo Mean	Welch t	df	P	Significance (p<0.05)
Avg Activity	3.268	3.519	-1.440	45.66	0.156	NS
Change in Activity	0.577	0.880	-1.230	36.14	0.226	NS
Avg Focus	3.872	3.733	0.595	46.98	0.555	NS
Change in Focus	0.307	0.640	-0.910	48.99	0.367	NS
Avg Distress	3.295	3.387	-0.506	48.80	0.615	NS
Change in Distress	-0.038	0.080	-0.376	46.17	0.709	NS
Avg Affability	4.320	4.306	0.094	48.07	0.925	NS
Change in Affability	-0.154	0.000	-0.613	48.97	0.542	NS
Avg Handling	3.654	3.694	-0.154	48.89	0.878	NS
Change in Handling	-0.683	0.732	0.070	47.50	0.945	NS

Table 3

Table 3. Study subject collar assignments, performance scores, and training status at the time of the study end.

Subject	Subject ID	DOB	Sex	Collar	Performance Score	Training Status
1	14-0557	3/20/14	F	Placebo	36.5	Eliminated
2	14-0551	3/20/14	M	Treatment	36.5	Pending
3	14-0550	3/20/14	M	Placebo	49.5	Pending
4	14-0553	3/20/14	M	Treatment	34.5	Pending
5	14-0552	3/20/14	M	Treatment	38.0	Eliminated
6	14-0558	3/20/14	F	Placebo	47.0	Eliminated
7	14-0559	3/20/14	F	Treatment	17.5	Pending
8	14-0554	3/20/14	M	Placebo	39.5	Eliminated
9	14-0555	3/20/14	F	Treatment	14.5	Eliminated
10	14-0556	3/20/14	F	Placebo	21.0	Eliminated
11	14-0570	4/23/14	F	Placebo	36.5	Eliminated
12	14-0563	4/23/14	M	Treatment	38.0	Eliminated
13	14-0568	4/23/14	M	Placebo	23.0	Eliminated
14	14-0567	4/23/14	F	Treatment	8.5	Eliminated
15	14-0573	5/1/14	M	Treatment	29.0	Eliminated
16	14-0569	4/23/14	M	Placebo	10.0	Eliminated
17	14-0566	4/23/14	M	Treatment	41.5	Eliminated
18	14-0577	5/1/14	F	Placebo	19.5	Eliminated
19	14-0564	4/23/14	F	Placebo	43.0	Pending
20	14-0562	4/23/14	M	Treatment	40.5	Eliminated
21	14-0572	5/1/14	M	Treatment	42.0	Eliminated
22	14-0575	5/1/14	F	Placebo	27.5	Eliminated
23	14-0571	5/1/14	F	Treatment	24.0	Eliminated
24	14-0579	5/1/14	M	Placebo	44.0	Pending
25	14-0574	5/1/14	F	Treatment	10.5	Eliminated
26	14-0576	5/1/14	M	Placebo	24.5	Pending
27	14-0581	5/28/14	F	Placebo	47.5	Pending
28	14-0584	5/28/14	M	Treatment	11.5	Eliminated
29	14-0583	5/28/14	F	Placebo	54.5	Pending
30	14-0580	5/28/14	F	Treatment	-	Eliminated
31	14-0582	5/28/14	M	Treatment	27.5	Eliminated
32	14-0585	6/21/14	M	Treatment	10.0	Eliminated
33	14-0586	6/21/14	F	Placebo	23.0	Eliminated
34	14-0587	6/21/14	F	Placebo	30.5	Eliminated
35	14-0594	7/1/14	F	Treatment	19.5	Eliminated
36	14-0592	7/1/14	F	Placebo	25.0	Eliminated

37	14-0590	7/1/14	F	Placebo	32.0	Eliminated
38	14-0591	7/1/14	F	Treatment	18.0	Eliminated
39	14-0593	7/1/14	M	Treatment	49.0	Eliminated
40	14-0835	7/9/14	M	Placebo	22.0	Eliminated
41	14-0841	7/9/14	F	Treatment	37.5	Pending
42	14-0838	7/9/14	F	Placebo	60.0	Pending
43	14-0839	7/9/14	F	Treatment	12.0	Eliminated
44	14-0840	7/9/14	M	Placebo	40.0	Eliminated
45	14-0844	7/9/14	F	Placebo	13.5	Eliminated
46	14-0832	7/9/14	F	Treatment	61.0	Pending
47	14-0836	7/9/14	M	n/a	-	-
48	14-0842	7/9/14	M	Treatment	58.0	Pending
49	14-0834	7/9/14	M	Treatment	46.5	Pending
50	14-0833	7/9/14	F	Placebo	55.5	Pending
51	14-0837	7/9/14	M	Treatment	54.5	Pending
52	14-0843	7/9/14	F	Placebo	58.0	Pending
n/a	14-0565	4/23/14	F	n/a	-	-
n/a	14-0578	5/1/14	M	n/a	-	-

Figure 1

Figure 1. Average Distress Scores

Figure 2

Figure 2. Change in Distress Score

Figure 3

Figure 3. Effects of pheromone on likelihood of elimination from training.