

# Differences in behavioral characteristics between dogs obtained as puppies from pet stores and those obtained from noncommercial breeders

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**Objective**—To compare the owner-reported prevalence of behavioral characteristics in dogs obtained as puppies from pet stores with that of dogs obtained as puppies from noncommercial breeders.

**Design**—Cross-sectional study.

**Animals**—Dogs obtained as puppies from pet stores (n = 413) and breeder-obtained dogs (5,657).

**Procedures**—Behavioral evaluations were obtained from a large convenience sample of current dog owners with the online version of the Canine Behavioral Assessment and Research Questionnaire, which uses ordinal scales to rate either the intensity or frequency of the dogs' behavior. Hierarchic linear and logistic regression models were used to analyze the effects of source of acquisition on behavioral outcomes when various confounding and intervening variables were controlled for.

**Results**—Pet store-derived dogs received significantly less favorable scores than did breeder-obtained dogs on 12 of 14 of the behavioral variables measured; pet store dogs did not score more favorably than breeder dogs in any behavioral category. Compared with dogs obtained as puppies from noncommercial breeders, dogs obtained as puppies from pet stores had significantly greater aggression toward human family members, unfamiliar people, and other dogs; greater fear of other dogs and nonsocial stimuli; and greater separation-related problems and house soiling.

**Conclusions and Clinical Relevance**—Obtaining dogs from pet stores versus noncommercial breeders represented a significant risk factor for the development of a wide range of undesirable behavioral characteristics. Until the causes of the unfavorable differences detected in this group of dogs can be specifically identified and remedied, the authors cannot recommend that puppies be obtained from pet stores. (*J Am Vet Med Assoc* 2013;242:1359–1363)

It has long been an article of faith among veterinarians and canine professionals that dogs obtained as puppies from pet stores have a higher prevalence of health and behavioral problems.<sup>1</sup> However, there has been a dearth of empirical studies to support this notion. In a retrospective survey of the owners of 737 adult dogs, Jagoe<sup>a</sup> found that dogs obtained from pet shops had a significantly higher prevalence of owner-directed (dominance-type) aggression and social fears (fear of strangers, children, and unfamiliar dogs) than did dogs from 5 other sources: breeders, animal shelters, friends or relatives, found or rescued off the streets, and home bred (ie, bred and reared in the current owner's home).<sup>2</sup> However, the sample size of pet store dogs in that study<sup>a</sup> was small (n = 20).

Bennett and Rohlf<sup>3</sup> investigated the frequency of potential problematic behavior patterns as reported

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## ABBREVIATIONS

C-BARQ	Canine Behavioral Assessment and Research Questionnaire
CBE	Commercial breeding establishment
NCB	Noncommercial breeder

by owners in a convenience sample of 413 companion dogs, of which 47 were obtained from pet stores. Results indicated that dogs purchased from pet shops or shelters were considered by their owners to be more unfriendly or aggressive than were dogs purchased from breeders and significantly more nervous than dogs bred by the present owner. However, by using broadly defined behavioral subscales rather than discrete behaviors, the researchers were not able to ascertain whether pet shop dogs had specific problematic behaviors more frequently than did dogs from other sources.

Mugford<sup>4</sup> reported analyzing a sample of 1,864 dogs with various behavioral problems and determined that “only 10% of purebred dogs obtained directly from breeders presented separation-related problems, whereas 55% of purebred dogs originating from so-called ‘puppy farms’ or ‘puppy mills’ present such problems.” Sample sizes and the way in which it was determined

that the dogs came from puppy farms or puppy mills were not reported.

Some inconsistent findings have also been reported. Pierantoni et al<sup>5</sup> compared owner-reported behaviors between 70 adult dogs separated from their litters at 30 to 40 days of age and 70 adult dogs separated from their litters at 2 months of age. Their analysis included the source of the dog classified into 3 categories: breeder, pet shop, or friend or relative. The researchers found no significant association between the source of the dog and the behavioral categories examined. In a study of the efficacy of a dog-appeasing pheromone in reducing stress associated with social isolation in puppies recently acquired from pet stores, Gaultier et al<sup>6</sup> noted that their data did not seem to support the hypothesis that puppies from pet stores constitute a special, at-risk population for the development of behavioral problems. The researchers reported that the puppies in that study<sup>6</sup> ( $n = 66$ ) did not appear to disturb their owners any more than those in a previous study by Taylor and Mills<sup>7</sup> involving puppies acquired from local pedigree dog breeders. However, the breeders in the latter study<sup>7</sup> included a semicommercial breeder and at least 1 puppy mill.<sup>b</sup>

Most puppies sold by pet stores in the United States are purchased from brokers, who may themselves be breeders but overwhelmingly acquire their puppies from high-volume breeding facilities, or CBEs, located throughout the United States.<sup>8</sup> Conditions in the CBEs, which supply tens of thousands of puppies to retail pet stores each year, vary widely. Conditions in CBEs range from modern, clean, and well-kept to squalid, noxious, and gravely detrimental to animal health and welfare.<sup>9-11</sup>

The purpose of the study reported here was to evaluate the hypothesis that dogs obtained as puppies from pet stores would be reported to have an increased prevalence of behavioral problems, compared with dogs obtained as puppies from NCBs.

## Materials and Methods

**Data collection**—Behavioral evaluations of the dogs were obtained by use of the online version of the C-BARQ, a standardized survey instrument with established reliability and validity characteristics.<sup>12</sup> The C-BARQ is designed to provide quantitative assessments of a wide array of behavioral characteristics of dogs and has been widely used as a research tool for comparing behavior in different dog populations.<sup>13-15</sup> The questionnaire consists of 100 items that ask respondents to indicate on a series of 5-point ordinal rating scales their dogs' typical responses to a variety of everyday situations during the recent past. The scales rate either the intensity (aggression, fear, and excitability subscales) or frequency (all remaining subscales and miscellaneous items) of the behaviors, with a score of 0 indicating the absence of the behavior and a score of 4 indicating the most intense or frequent form of the behavior. The C-BARQ currently comprises 14 behavioral factors or subscales and a further 22 miscellaneous stand-alone items. Higher scores are generally less favorable for all items and subscales, with the exception of trainability, for which higher scores are more desirable. Owners were also asked to indicate

the dog's current age at the time the survey was completed, whether there were other dogs living in the same household, and whether the dog was used for specific working or recreational roles, including breeding or showing, field trials or hunting, other sports (eg, agility, racing, or sledding), and working roles (eg, search and rescue, service, or sheep herding). To obtain information on the source from which the dog was acquired, owners were also asked to respond to the question, "where did you acquire this dog?" Possible responses included the following: bred him/her myself; from a breeder; from a shelter or rescue group; from a neighbor, friend, or relative; bought from a pet store; adopted as a stray; and other. Consistent with the 2 previous studies<sup>3,a</sup> that offered pet-owning participants the choice of breeder as the source of the dog, the question in the C-BARQ regarding the source of the dog does not define the term breeder.

**Sample**—The online C-BARQ was advertised originally via an article in the newsmagazine of the Veterinary Hospital of the University of Pennsylvania and by notices sent to Philadelphia-area veterinary clinics and the top 20 US breed clubs, as determined on the basis of American Kennel Club registrations. Availability of the survey then spread via word of mouth. No geographic limitations were applied, and participation included residents of the United States as well as other countries. A subset of these data consisting entirely of pet dogs whose owners reported obtaining them either from breeders ( $n = 5,657$ ) or pet stores (413) was used for analysis. Breeder-obtained dogs were selected as the comparison group for the following reasons: age at the time of acquisition would most closely match pet store-obtained dogs; for the most part, breeder-obtained dogs are purebred as are those from pet stores; and the life history of the dog prior to purchase in breeder-obtained puppies is relatively standardized, thereby reducing the amount of environmental variability among the dogs of this group. These assumptions apply to the United States and may have less validity in other countries.

**Statistical analysis**—Two-level hierarchic linear or logistic regression models were used to analyze the data on behavioral measures.<sup>16</sup> The outcome variables (attachment and attention seeking, chasing, trainability, excitability, and energy) in the hierarchic linear model were treated as normally distributed continuous variables. All other behavioral variables were dichotomized (eg, 0 or > 0) because they were typically highly skewed and it was impossible to identify a suitable transformation method to normalize their distribution. These were analyzed with 2-level mixed logistic models. Both types of model aimed to assess the relationship between source of acquisition (eg, pet store vs breeder) and behavior while controlling for various confounding variables (other dogs in household, working or recreational roles, sex, and body weight) or intervening variables (neutered vs sexually intact and age at the time of evaluation). All possible 2-way interactions between source of acquisition and confounding and intervening variables were explored and accounted for in the modeling process. Nonsignificant confounding and intervening variables and interaction effects were removed from the

model. Breed was also included in both models as a random effect to account for clustering of dogs at the breed level. Linear and logistic models were fit via restricted and full maximum likelihood estimation procedures. The analysis was performed with statistical software<sup>17</sup> by use of subject-specific models.<sup>c,d</sup> For all comparisons, a value of  $P < 0.05$  was considered significant.

## Results

According to the results of the multiple regression analyses, dogs acquired from pet stores differed significantly from those acquired from breeders on 12 of 14 of the C-BARQ behavioral subscales. In no category did pet store dogs have a more desirable score than breeder dogs (Tables 1 and 2). The strongest effects were observed in relation to aggressive behavior. For example, sexually intact pet store dogs were 3 times as likely to have owner-directed aggression as were sexually intact dogs acquired from breeders, and pet store dogs were nearly twice as likely to have aggression toward unfamiliar dogs (dog-directed aggression). Pet store dogs were also 30% to 60% more likely to have stranger-directed aggression, aggression to other household dogs, fear of dogs

and nonsocial stimuli, separation-related problems, and touch sensitivity. In addition, they were somewhat more excitable, energetic, and attention seeking and generally less trainable, although this was only true for dogs that did not participate in working or recreational activities. The only C-BARQ subscales that were not significantly different between pet store and breeder-derived dogs were chasing and stranger-directed fear. In addition, pet store–obtained dogs had a range of miscellaneous behavioral problems at significantly higher frequencies than did those acquired from breeders (eg, escaping from the home, sexual mounting of people and objects, and most forms of house-soiling).

## Discussion

Results of this study supported the view that dogs obtained as puppies from pet stores are more likely to develop behavioral problems as adults, compared with dogs obtained from NCBs. The retrospective nature of the data used in this analysis did not permit determinations of causality. However, there are several potential explanations for the differences between pet store and NCB dogs.

Table 1—Results of linear regression models comparing behavioral variables in dogs obtained from pet stores versus dogs obtained from NCBs.

Variable	Other variables controlled	Predictor	Effect	95% CI	P value
Excitability	1,2,3,4,6	PS	0.204	0.12 to 0.29	< 0.001
Energy	1,2,3,4,6	PS	0.109	0.004 to 0.21	0.043
Chasing		PS	0.002	-0.13 to 0.10	0.769
Attachment and attention seeking	1,2,3,4,5,6	PS	0.204	0.12 to 0.29	< 0.001
Trainability	1,2,3,4,5,6	PS–Not working dog	-0.195	-0.26 to -0.13	< 0.001
		PS–Working dog	0.098	-0.07 to 0.27	0.262

PS = Acquired from pet store.  
Other variables controlled were as follows: 1 = other dogs, 2 = dogs with working or recreational roles, 3 = sex, 4 = weight, 5 = neutered, 6 = age at time of evaluation (nonsignificant intervening variables [those variables that intervene the relationship between variable and predictor] were removed from the analyses).

Table 2—Results of logistic regression models comparing behavioral variables in dogs obtained from pet stores versus dogs obtained from NCBs.

Variable	Other variables controlled	Predictor	OR	95% CI	P value
Separation-related behavior	1,2,3,4,5,6	PS	1.58	1.19–2.11	0.002
Owner-directed aggression	1,2,3,4,5,6	PS–Not neutered	3.13	1.87–5.23	< 0.001
		PS–Neutered	1.54	1.16–2.06	0.003
Stranger-directed aggression	1,2,3,4,5,6	PS	1.59	1.18–2.16	0.003
Nonsocial fear	1,2,3,4,5	PS	1.44	1.01–2.07	0.047
Dog rivalry	1,2,3,4,6	PS	1.35	1.05–1.74	0.021
Dog-directed fear	1,2,3,4,5	PS	1.33	1.03–1.71	0.030
Dog-directed aggression	1,2,3,4,5,6	PS	1.96	1.44–2.67	< 0.001
Touch sensitivity	1,2,3,4,5,6	PS	1.58	1.18–2.11	0.002
Escapes from home or yard	1,2,3,4,5,6	PS	4.14	1.75–9.83	0.001
Rolls in odorous material		PS	0.86	0.67–1.09	0.214
Coprophagia			1.08	0.86–1.36	0.502
Chews objects			1.07	0.84–1.36	0.590
Mounts objects or people	1,2,3,4,5		1.39	1.1–1.75	0.006
Urinates against objects or furnishings	1,2,3,4,5,6	PS	1.77	1.32–2.39	< 0.001
Submissive urination	1,2,3,4,5,6	PS	1.53	1.13–2.07	0.007
Urinates when left alone	1,2,3,4,5,6	PS	1.96	1.52–1.52	< 0.001
Defecates when left alone	1,2,3,4,5	PS	1.68	1.31–2.16	< 0.001

See Table 1 for key.

The formative stages of the puppy's life in the CBE are periods where stress may exert an impact on brain development. Although no studies on sources of stress in CBEs or their potential effects on the well-being of the dogs have been published, sources of stress have been investigated in dogs living in confinement in kennels,<sup>18–21</sup> animal shelters,<sup>22,23</sup> and laboratories.<sup>24,25</sup> Similar stressors have been documented in the CBE environment,<sup>10</sup> and it is therefore reasonable to suggest that the effects applied also to the dogs in the present study, despite some differences in background, housing, and husbandry. Specific factors that have been determined to be associated with stress in dogs living in confined environments include spatial restriction,<sup>18,19,23</sup> extreme temperatures,<sup>9,26</sup> aversive interactions with kennel staff,<sup>26,27</sup> lack of perceived control or the capacity to avoid or regulate exposure to aversive stimuli,<sup>20–23</sup> and limited access to positive human and conspecific social interactions.<sup>18,24,25</sup> A recent study<sup>11</sup> on the mental health of dogs formerly used as breeding stock in CBEs found severe and long-lasting adverse effects in dogs living in this type of environment, offering evidence of the magnitude of stressors in CBEs.

The stressors in the CBE environment may have acted at 2 stages of the developing puppies' lives: the prenatal period and the first 8 weeks after birth. A large body of research in humans and other animals has convincingly determined that prenatal stress (ie, stress experienced by a pregnant female) causes alterations to the hypothalamic-pituitary-adrenal axis of the developing fetus that may manifest later in life as an impaired ability to cope with stress,<sup>22</sup> abnormal social behavior,<sup>28,29</sup> and increased emotionality and fear-related behavior.<sup>30</sup> All of these outcomes are consistent with the differences detected in pet store– versus NCB-obtained dogs (ie, increased aggression, fear of dogs and nonsocial stimuli, and excitability). Substantial evidence in humans and other animals indicates that stressful experiences in early life may have extensive and enduring effects with strong correlations to later development of behavioral abnormalities and psychopathologic abnormalities.<sup>31–35</sup> In dogs, Fox and Stelzner<sup>36</sup> detected a short period at approximately 8 weeks of age when puppies are hypersensitive to distressing psychological or physical stimuli and during which a single unpleasant experience could result in long-term aversive or abnormal effects. Transport-related stress was suggested by both Mugford<sup>4</sup> and Gaultier et al<sup>6</sup> to be a potentially critical factor in the early lives of puppies from CBEs as they are shipped to pet stores throughout North America. Mugford,<sup>4</sup> Serpell and Jagoe,<sup>2</sup> and Bennett and Rohlf<sup>3</sup> have each suggested that a reason for pet store and CBE puppies to have a high prevalence of behavioral problems later in life is inadequate early socialization. In addition, genetic influences may play a role in the differences between pet store and NCB dogs, because a genetic basis for behavioral traits in dogs is consistent with findings observed in dogs of the present study, including fear, aggression, emotional reactivity, and nonspecific alterations in temperament and personality.<sup>27,37,38</sup>

The reported differences in the 2 groups of dogs in the present study could be attributable to a number of owner-related factors. It is possible that people who buy puppies from pet shops may use different degrees or methods of training than people who buy puppies

from an NCB. The importance of training in the development of problem behaviors was recently elucidated in the study<sup>3</sup> of the relationship of potentially problematic behaviors with other variables. The researchers found that for the 5 behavioral subscales, the strongest predictor for scoring undesirably in 3 of the 5 subscales was the level of training the dog received. The present study did not attempt to collect demographic or background information on the dog owners; therefore, the degree to which such factors may have contributed to the findings could not be assessed. An additional owner-related consideration is that it is possible that people who buy puppies from pet stores simply report potentially problematic behaviors more readily than do others, irrespective of the dog's actual behavior.

The data support the notion that dogs obtained as puppies from pet stores have substantial adverse behavioral differences, compared with dogs obtained from NCBs. Taken individually, however, the specific factors that differ between the 2 groups are not readily attributable to a single definitive explanation. For example, stranger-directed aggression may be attributable to inadequate socialization, maltreatment by humans, genetic factors, and prenatal stress. Taken collectively, no single explanatory factor appears capable of accounting for the differences between the 2 groups. For example, although inadequate socialization may explain increased aggression, the most prominent emotional consequence of insufficient socialization is fear,<sup>27,39</sup> and whereas aggression toward humans (owners and unfamiliar people) was increased, fear toward humans was not.

There were a number of limitations to the present study. The sample of dog owners was self-selected and therefore a potential source of bias. The question in the C-BARQ regarding the source of the dogs did not define breeder, leaving the participants to define the term for themselves. Accordingly, a breeder source could have indicated either type of NCB (hobby breeder or backyard breeder), and the level and type of care differ between the 2 types. These differences are presumably minor in comparison to the differences between NCBs and CBEs. It is also conceivable that the source of some dogs specified by the owner as breeder was a CBE; however, it is reasonable to conclude that there would be no overlap between breeder and pet store categories (ie, no owner with a dog coming from a pet store would select breeder as a source, and no owner with a dog coming from a breeder would select pet store as a source).

Results of the present study indicated that compared with dogs obtained as puppies from NCBs, dogs obtained as puppies from pet stores had significantly greater aggression toward human family members, unfamiliar people, and other dogs; fear of other dogs and nonsocial stimuli; separation-related problems; and urination and defecation problems in the home. On almost all behavioral variables measured, pet store dogs received less favorable scores than breeder-obtained dogs. The diversity of behavioral differences between pet store–obtained and breeder-obtained dogs suggests a multifactorial cause and, accordingly, a multifactorial approach to correction; however, the data did not permit determination of the specific contributory factors and the degree of influence they exerted. In addition,

because we did not compare the 2 groups of dogs in this study with other sources of dogs, the results should not be interpreted as an endorsement of any particular source of dogs. On the basis of these findings combined with earlier findings regarding pet store–obtained dogs, until the causes of the unfavorable differences detected in this group of dogs can be specifically identified and remedied, we cannot recommend that puppies be obtained from pet stores.

- a. Jagoe JA. *Behaviour problems in the domestic dog: a retrospective and prospective study to identify factors influencing their development*. PhD thesis, University of Cambridge, Cambridge, England, 1994.
- b. Taylor K, Senior Science Advisor, Secretariat to the International Council for Animal Protection in Pharmaceutical Programmes (ICAPPP), British Union for the Abolition of Vivisection (BUAV), 16a Crane Grove, London, England: Personal communication, 2011.
- c. xtmixed, Stata Statistical Software, release 11, StataCorp, College Station, Tex.
- d. xtmelogit, Stata Statistical Software, release 11, StataCorp, College Station, Tex.

## References

1. Fumarola AJ. With best friends like us who needs enemies? The phenomenon of the puppy mill, the failure of legal regimes to manage it, and the positive prospects of animal rights. *Buffalo Environ Law J* 1999;6:253–289.
2. Serpell J, Jagoe JA. Early experience and the development of behavior. In: Serpell J, ed. *The domestic dog: its evolution, behavior and interactions with people*. Cambridge, England: Cambridge University Press, 1995:79–102.
3. Bennett PC, Rohlf VI. Owner-companion dog interactions: relationships between demographic variables, potentially problematic behaviors, training engagement and shared activities. *Appl Anim Behav Sci* 2007;102:65–84.
4. Mugford RA. Canine behavioral therapy. In: Serpell J, ed. *The domestic dog: its evolution, behavior and interactions with people*. Cambridge, England: Cambridge University Press, 1995:139–152.
5. Pierantoni L, Albertini M, Pirrone F. Prevalence of owner-reported behaviors in dogs separated from the litter at two different ages. *Vet Rec* 2011;169:468–474.
6. Gaultier E, Bonnafous L, Vienet-Legue D, et al. Efficacy of dog-appeasing pheromone in reducing stress associated with social isolation in newly adopted puppies. *Vet Rec* 2008;163:73–80.
7. Taylor K, Mills DS. A placebo-controlled study to investigate the effect of dog appeasing pheromone and other environmental and management factors on the reports of disturbance and house soiling during the night in recently adopted puppies (*Canis familiaris*). *Appl Anim Behav Sci* 2007;105:358–368.
8. Hunte Corp. Available at: [www.huntecorp.com](http://www.huntecorp.com). Accessed Jun 5, 2011.
9. USDA. Final rules: animal welfare; 9 CFR parts 1 and 2. Available at: [www.nal.usda.gov/awic/pubs/Legislat/awafin.shtml](http://www.nal.usda.gov/awic/pubs/Legislat/awafin.shtml). Accessed Jun 4, 2011.
10. USDA. Animal welfare reports and electronic freedom of information frequent requests. Available at: [www.aphis.usda.gov/animal\\_welfare/efoia](http://www.aphis.usda.gov/animal_welfare/efoia). Accessed Feb 8, 2012.
11. McMillan FD, Duffy DL, Serpell JA. Mental health of dogs formerly used as ‘breeding stock’ in commercial breeding establishments. *Appl Anim Behav Sci* 2011;135:86–94.
12. Hsu Y, Serpell JA. Development and validation of a questionnaire for measuring behavior and temperament traits in pet dogs. *J Am Vet Med Assoc* 2003;223:1293–1300.
13. Serpell JA, Hsu Y. Effects of breed, sex, and neuter status on trainability in dogs. *Anthrozoos* 2005;18:196–207.
14. Duffy DL, Hsu Y, Serpell JA. Breed differences in canine aggression. *Appl Anim Behav Sci* 2008;114:441–460.
15. Van den Berg SM, Heuven HCM, Van den Berg L, et al. Evaluation of the C-BARQ as a measure of stranger-directed aggression in three common dog breeds. *Appl Anim Behav Sci* 2010;124:136–141.
16. Dohoo I, Martin W, Stryhn H. *Veterinary epidemiologic research*. 2nd ed. Charlottetown, PE, Canada: VER Inc, 2009.
17. StataCorp. *Stata 11 base reference manual*. College Station, Tex: Stata Press, 2009:242–278, 306–355.
18. Beerda B, Schilder MB, van Hooff JA, et al. Chronic stress in dogs subjected to social and spatial restriction. I. Behavioral responses. *Physiol Behav* 1999;66:233–242.
19. Beerda B, Schilder MB, Bernadina W, et al. Chronic stress in dogs subjected to social and spatial restriction. II. Hormonal and immunological response. *Physiol Behav* 1999;66:243–254.
20. Stephen JM, Ledger RA. An audit of behavioral indicators of poor welfare in kennelled dogs in the United Kingdom. *J Appl Anim Welf Sci* 2005;8:79–96.
21. Taylor KD, Mills DS. The effect of the kennel environment on canine welfare: a critical review of experimental studies. *Anim Welf* 2007;16:435–447.
22. Tuber DS, Miller DD, Caris KA, et al. Dogs in animal shelters: problems, suggestions, and needed expertise. *Psychol Sci* 1999;10:379–386.
23. Wells DL, Graham L, Hepper PG. The influence of length of time in a rescue shelter on the behavior of kennelled dogs. *Anim Welf* 2002;11:317–325.
24. Hughes HC, Campbell S, Kenney C. The effects of cage size and pair housing on exercise of Beagle dogs. *Lab Anim Sci* 1989;39:302–305.
25. Hubrecht RC. A comparison of social and environmental enrichment methods for laboratory housed dogs. *Appl Anim Behav Sci* 1993;37:345–361.
26. Morgan KN, Tromborg CT. Sources of stress in captivity. *Appl Anim Behav Sci* 2007;102:262–302.
27. Scott JP, Fuller JL. *Genetics and the social behavior of the dog*. Chicago: University of Chicago Press, 1965.
28. Braastad BO. Effects of prenatal stress on behavior of offspring of laboratory and farmed mammals. *Appl Anim Behav Sci* 1998;61:159–180.
29. Clarke AS, Schneider ML. Prenatal stress has long-term effects on behavioral responses to stress in juvenile rhesus monkeys. *Dev Psychobiol* 1993;26:293–304.
30. Lehmann J, Stöhr T, Feldon J. Long-term effects of prenatal stress experience and postnatal maternal separation on emotionality and attentional processes. *Behav Brain Res* 2000;107:133–144.
31. Edwards VJ, Holden GW, Felitti VJ, et al. Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: results from the adverse childhood experiences study. *Am J Psychiatry* 2003;160:1453–1460.
32. Ladd CO, Huot RL, Thirivikraman KV, et al. Long-term behavioral and neuroendocrine adaptations to adverse early experience. In: Mayer EA, Saper CB, eds. *Progress in brain research: the biological basis for mind body interactions*. Amsterdam: Elsevier, 2000:81–103.
33. Gunnar M, Quevedo K. The neurobiology of stress and development. *Annu Rev Psychol* 2007;58:145–173.
34. Tanapat P, Hastings NB, Rydel TA, et al. Exposure to fox odor inhibits cell proliferation in the hippocampus of adult rats via an adrenal hormone-dependent mechanism. *J Comp Neurol* 2001;437:496–504.
35. Dettling AC, Feldon J, Pryce CR. Early deprivation and behavioral and physiological responses to separation/novelty in the marmoset. *Pharmacol Biochem Behav* 2002;73:259–269.
36. Fox MW, Stelzner D. Behavioral effects of differential early experience in the dog. *Anim Behav* 1966;14:273–281.
37. Saetre P, Strandberg E, Sundgren PE, et al. The genetic contribution to canine personality. *Genes Brain Behav* 2006;5:240–248.
38. Svartberg K. Breed-typical behavior in dogs—historical remnants or recent constructs? *Appl Anim Behav Sci* 2006;96:293–313.
39. Horwitz DF, Neilson JC. *Blackwell's five-minute veterinary consult clinical companion—canine and feline behavior*. Ames, Iowa: Blackwell Publishing, 2007.