STUDIES PLAYBOOK

Peer-Reviewed Literature Behind the Force-Free Position

A study-by-study reference of the peer-reviewed evidence base for force-free dog training, organized by methodology group, with citations, key findings, deployment notes, and honest acknowledgments of methodological limits.

Companion to The Scientific Case Against Aversive Dog Training Equipment and Methods.

AUTHORED BY

Will Bangura

M.S., CAB-ICB, CBCC-KA, CPDT-KA, FDM, FFCP

Certified and Accredited Canine Behaviorist

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> This document organizes the peer-reviewed literature behind the force-free position by study, with one profile per study. The policy paper organizes the same material by argument; this playbook organizes it by source. The convergent welfare evidence does not require any individual study to be perfect. It requires the agreement across studies to be robust, which it is.

How to Use This Playbook

When to use this document. When an opponent says "show me a study," when an opponent challenges a specific paper ("Cooper had problems," "the cortisol was not significant," "Johnson and Wynne proves you wrong"), when preparing for a podcast appearance or formal debate, when writing a response that requires citing a specific finding accurately, when teaching the literature in a continuing education context, or when mentoring a junior practitioner who is learning the evidence base.

Structure of each profile. Title and full citation with hyperlinked DOI. Design and sample in one to two sentences. Key findings. Where applicable, the proponent reading and the response. Deployment, meaning what argument the study most strongly supports. Limits and honest acknowledgments where applicable, included so the practitioner is not surprised by methodological critiques.

The honest treatment of limits matters. The practitioner who already knows a study's weaknesses cannot be surprised by a critic who points them out. The convergent welfare evidence does not require any individual study to be perfect. It requires the agreement across studies to be robust, which it is. The pattern across the literature is sufficiently convergent to support precautionary welfare policy.

Profile groups. Group A: Controlled experimental studies of aversive equipment. **Group B:** Direct observational and clinical studies. **Group C:** Population-level survey studies. **Group D:** Affective-state, cognitive bias, and attachment studies. **Group E:** Mechanical and physical effects (neck-pressure equipment). **Group F:** Pain neuroscience and sensory engagement. **Group G:** Threat circuitry, controllability, and avoidance learning. **Group H:** The contested study (Johnson and Wynne 2024). **Group I:** Proponent-cited studies and how to address them. **Group J:** Foundational and theoretical works. **Group K:** Dog training adjacent reviews and welfare-framework references.

A note on the personal communications. The Pessoa and Knight personal communications, folded as interpretive notes into the Limbachia et al. (2021) and Wood et al. (2014) profiles in Group G, are interpretive support, not primary empirical evidence. They confirm the reading of the published studies as represented in the policy paper. They do not introduce new empirical findings. Their value is that the senior authors of the studies most often cited by proponents have explicitly disclaimed the proponent reading of their own work.

Table A. Comprehensive Studies Summary

This table consolidates the studies covered in the playbook by group, with the design and the key finding in compact form. The Group column corresponds to the group letters used in the playbook body (A through K). Studies in Groups A through G support the force-free position; Group H is contested; Group I consists of studies cited by proponents that, on examination, do not support the proponent reading.

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Group A. Controlled Experimental Studies of Aversive Equipment				
Cooper et al. (2014)	A	RCT, 63 pet dogs referred for recall problems; 3 groups (industry e-collar trainers, same trainers without, reward-based)	Reward-based equivalent or better outcomes; e-collar group showed elevated stress behaviors. No necessity advantage even with industry-nominated best-practice trainers.	"E-collars are necessary"; "professionals can use safely"
China, Mills, & Cooper (2020)	A	Comparative re-analysis of Cooper 2014 dataset focused on training efficacy across 3 groups	Reward-based achieved equivalent outcomes more efficiently. Positive reinforcement most efficient method tested.	"E-collars are faster or more reliable"
Group B. Direct Observational and Clinical Studies				
Schilder & van der Borg (2004)	B	Behavioral observation; protection-trained working dogs (German Shepherds in guard-dog training); shock collar use	Stress responses persisted in non-training contexts including presence of trainer or environment, indicating conditioned emotional response.	"Dog is fine when collar is off"
Deldalle & Gaunet (2014)	B	Direct observational, two French training schools (negative reinforcement vs. positive reinforcement)	Negative-reinforcement school dogs showed more stress behaviors and less gaze toward guardian during training.	"Dog looks happy and engaged"
Rooney & Cowan (2011)	B	Home observational, 53 dog-guardian pairs; assessment of training, learning, behavior problems	Punishment predicted lower learning and more behavior problems. Reward-based predicted better outcomes on novel tasks.	"Punishment teaches faster"
Herron, Shofer, & Reisner (2009)	B	Clinical referral survey, 140 dog cases at UPenn Veterinary Behavior Clinic	Confrontational techniques elicited aggression: hit/kick 43%, alpha roll 31%, dominance down 29%, scruff shake 26%, choke/pinch 11%, shock collar 10%.	"Confrontational handling works for aggression"
Group C. Population-Level Survey Studies				
Hiby, Rooney, & Bradshaw (2004)	C	Survey, 364 UK dog guardians; training methods, obedience, behavior problems	Reward-based methods correlated with higher obedience. Punishment-based correlated with significantly more behavior problems.	"Punishment is effective" (foundational early study)

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Blackwell et al. (2008)	C	Survey, 192 UK dog guardians; methods and behavior problem occurrence	Highest aggression scores in dogs whose guardians combined positive reinforcement with positive punishment.	"Balanced is moderate"
Arhant et al. (2010)	C	Survey, 1,276 Austrian dog guardians; smaller and larger dogs analyzed separately	Punishment correlated with higher aggression, excitability, anxiety in both smaller and larger dogs.	"Size moderates the welfare effect"
Blackwell et al. (2012)	C	Survey, 3,897 UK dog guardians focused on e-collar use	E-collar users reported lower training success. Guardian attendance at training classes and gender were strongest predictors of use, not dog characteristics.	"I only use e-collars on dogs that need them"
Casey et al. (2014)	C	Population-level multivariable analysis of risk factors for human-directed aggression	Adjusted increased odds of family-member aggression in dogs trained with aversive methods.	Corroborates Herron at population level
Masson, Nigron, & Gaultier (2018b)	C	Survey, 1,251 French dog guardians; e-collar use and acquisition patterns	71.8% of users without professional advice; 75% had tried <=2 alternatives; 7% of dogs presented with physical wounds.	"Professionals use these properly"
Masson et al. (2018a)	C	European multi-author review article assembling welfare evidence and clinical considerations on electronic training devices	Concluded electronic training devices pose welfare risks not justified by efficacy data; less intrusive methods available.	"Professionals support these tools" fails. Multi-country professional review concluded the opposite.
Starinsky, Lord, & Herron (2017)	C	Survey, 974 US dog guardians; comparison of containment methods	Escape rates: electronic fence 44%, physical fence 23%, tethered 27%. No clear protective effect of electronic containment on bite or escape outcomes.	"Electronic containment improves safety"
Group D. Affective-State, Cognitive Bias, and Attachment Studies				
Vieira de Castro et al. (2019)	D	Strange Situation Procedure adapted for dogs; aversive vs. reward-based training	Aversive training associated with significantly weaker dog-guardian attachment.	"Aversive builds respect or relationship"
Vieira de Castro et al. (2020)	D	Multi-measure welfare study, 92 pet dogs from 7 Portuguese training schools	Aversive-trained dogs showed more stress behaviors, higher post-training cortisol, more pessimistic cognitive bias. Convergence across all three measures.	"Welfare data are inconclusive"
Casey et al. (2021)	D	Cognitive bias test (judgment-bias paradigm); 104 dogs	Dogs trained with two or more aversive methods showed significantly more pessimistic cognitive bias. Validated indicator of persistent affective state.	"Welfare effect is short-term"
Group E. Mechanical and Physical Effects (Neck-Pressure Equipment)				

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Pauli et al. (2006)	E	IOP measurement in 51 eyes of 26 dogs; collar vs. harness pressure under pulling	IOP rose significantly with collar pressure during ordinary pulling, not with harness. Mechanism: jugular compression obstructing aqueous outflow.	"Ordinary collar use is harmless"
Carter, McNally, & Roshier (2020)	E	7 collar types tested on simulated canine neck model with pressure sensor; force levels 40N, 70N, 141N	Pressures 83 to 832 kPa. No collar tested produced pressure low enough to mitigate injury risk under pull.	Closes prong/choke mechanical-safety claim
Hunter, Blake, & De Godoy (2019)	E	Force and pressure measurement on canine neck during ordinary on-leash walking	Peak contact pressure 44.61 N/cm²; significant differences in force transmission across collar constructions.	Establishes everyday-walking pressure
Grohmann et al. (2013)	E	Peer-reviewed case report: 1-yr German Shepherd, punitive choke-chain hanging technique	Severe ischemic brain damage from carotid compression; dog euthanized due to severity.	Documented fatal outcome from choke-chain technique
Rozanski (2022)	E	Clinical veterinary review on tracheal collapse in dogs	Repeated collar pressure recognized clinical concern for tracheal collapse; harnesses recommended over collars for affected dogs.	Clinical veterinary support for harness over collar
Group F. Pain Neuroscience and Sensory Engagement				
Dubin & Patapoutian (2010)	F	Peer-reviewed review of nociceptor neurobiology, Journal of Clinical Investigation	Nociceptors fire below the threshold of tissue injury; their function is to warn the organism away from potentially damaging stimuli before damage occurs.	"No tissue damage means no welfare cost"
Raja et al. (2020)	F	IASP revised pain definition; multidisciplinary task force, published in Pain	Pain is defined as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage. Definition applies to nonhuman animals.	"Pain requires tissue damage"
Affolter & Moore (1994)	F	Peer-reviewed review of canine and feline skin histology, Clinics in Dermatology	Canine haired-skin epidermis is approximately 3 to 5 cell layers thick, considerably thinner than human epidermis.	"Self-test on human skin proves it's mild"
Lines, van Driel, & Cooper (2013)	F	Engineering measurement of 13 commercial e-collar models; impedance on 27 dogs; published in Veterinary Record	87-fold range in stimulus energy; within-collar median ratio 81; 2 of 13 collars had manufacturing faults; user setting cannot be assumed to deliver similar stimulus.	"A low setting is mild and predictable"
Group G. Threat Circuitry, Controllability, and Avoidance Learning				

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
LeDoux (2014)	G	Theoretical/review paper on threat processing and fear conditioning neuroscience	Amygdala-centered defensive circuitry processes aversive events. Circuit activation is not welfare-neutral.	Foundational reference for threat-circuit argument
Cain (2019)	G	Review of contemporary active avoidance research	Active avoidance is goal-directed instrumental behavior under threat. Shift from fear to anxiety state during effective avoidance does not eliminate underlying threat representation.	"Calm-looking dog is welfare-neutral"
Maier & Watkins (2005)	G	Review of stressor controllability research integrating dorsal raphe, serotonergic, and CRF system findings	Controllability modulates downstream consequences of aversive stressors but does not render the stressor benign.	"If the dog can control the aversive, it's welfare-neutral"
Limbachia et al. (2021)	G	fMRI of human participants under varying controllability over aversive stimulation	Controllability attenuates threat-related neural responding but does not eliminate it.	"Controllability makes aversive use safe"
Wood, Ver Hoef, & Knight (2014)	G	fMRI and skin conductance study of threat-elicited responses and emotional modulation	Amygdala mediates emotional modulation of threat-elicited responses.	"Predictability makes aversive neutral"
Sears et al. (2026)	G	Shuttlebox active avoidance in rats; novel safety-signal devaluation; chemogenetic suppression of dorsomedial vs dorsolateral striatum	Safety signals acquire value only from inverse relationship with the aversive contingency. Overtrained avoidance becomes habitual via dorsolateral striatum, the same circuit implicated in OCD and early-life stress survivors.	"Safety reinforcement makes it positive"
Christiansen et al. (2001)	G	Field study of remote shock-collar use in 114 hunting dogs across two years of sheep pasture confrontation testing	Welfare measures relied largely on guardian report and temperament tests; methodological thinness prevents the dataset from supporting a welfare-benign reading.	"Controllable, predictable shock-collar use is welfare-benign"
L. Pessoa, personal communication, April 10, 2026	G	Written correspondence with senior author of Limbachia et al. (2021); interpretive support	Senior author confirmed in writing that his published research should not be interpreted as rendering controllable aversive stimulation neurologically neutral or welfare-benign.	Closes the controllability defense at authorial intent
D. C. Knight, personal communication, April 17, 2026	G	Written correspondence with senior author of Wood et al. (2014); interpretive support	Senior author confirmed in writing that his research, including conditioned diminution of unconditioned responses, cannot support the proposition that predictable aversive stimulation is neutral or benign.	Closes the predictability defense at authorial intent

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Arnsten (2009)	G	Review of stress signaling pathways in mammalian prefrontal cortex	Stress exposure produces measurable prefrontal cortex changes. Effects scale with cumulative exposure.	Extends welfare argument from acute to cumulative exposure effects
Vyas et al. (2002)	G	Rodent neuroanatomical study of dendritic remodeling in hippocampal and amygdaloid neurons following chronic stress	Chronic stress produces opposite remodeling: hippocampal atrophy and amygdala hypertrophy. Brain structurally primed to respond more strongly to future threats.	"The dog will recover" fails
Rosenkranz, Venheim, & Padival (2010)	G	Electrophysiological study of amygdala neuronal excitability following chronic stress exposure	Chronic stress produces measurable amygdala hyperexcitability. Cells fire more readily in response to subsequent stimuli. Effect persists beyond stress period.	Functional companion to Vyas 2002. Cumulative welfare cost is structural
McEwen (2012)	G	Theoretical and review paper on cumulative effects of chronic stress integrating decades of HPA axis findings	Chronic stress produces cumulative effects through allostatic load. Adaptive stress responses return to baseline; maladaptive cumulative load does not.	"Single-session stress is the welfare-relevant measure" fails
Gillan et al. (2014)	G	Experimental study of avoidance habit formation in human OCD patients vs. controls	OCD patients show enhanced avoidance habits, stronger reliance on habitual avoidance even when avoidance contingency changed. Dorsolateral striatum implicated.	Clinical-population companion to Sears 2026
Gordon, Patterson, & Knowlton (2020)	G	Behavioral study of human participants with histories of early-life stress, tested on novel instrumental avoidance learning	Survivors of early-life stress show preponderance of habitual responding on novel avoidance task. Same dorsolateral striatum-mediated habitual circuit implicated.	Developmental-stress companion to Sears 2026 and Gillan 2014
Group H. The Contested Study				
Johnson & Wynne (2024)	H	Comparison of training methods for stopping predatory chasing under specific protocol conditions	Narrow efficacy under specific experimental conditions, NOT necessity, welfare neutrality, or broad real-world superiority. Methodology challenged in peer review.	Frequently cited by proponents
Bastos, Warren, & Krupenye (2025)	H	Peer-reviewed methodological critique of Johnson & Wynne (2024)	Identifies methodological concerns about the reward-based comparison condition, training trial duration, and baseline comparability of groups.	Anchors critique of Johnson & Wynne
Johnson & Wynne (2025)	H	Authors' published response to Bastos et al. (2025)	Did not resolve the substantive methodological concerns raised about the original protocol.	Note when J&W invoked
Bangura (2025) SSRN	H	Separately published methodological critique by present author	Raises additional concerns about internal validity and generalizability to general pet dog populations.	Companion critique to Bastos

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Group I. Proponent-Cited Studies (Do Not Actually Support Proponent Reading)				
Salgirli et al. (2012)	I	Comparison of e-collar, pinch collar, quitting signal in 42 Belgian Malinois police dogs	Compared three aversive interventions, not against reward-based. Senior author Schalke is public e-collar critic.	Cited to argue e-collars less stressful than pinch
Steiss et al. (2007)	I	Plasma cortisol in 24 kennel dogs across bark collar conditions (8 per group)	Modest cortisol elevation under specific conditions. Cortisol alone is not comprehensive welfare assessment.	Cited to argue bark collars are welfare-neutral
Schalke et al. (2007)	I	Dogs trained with e-collars under varying predictability and contingency conditions	All groups experienced welfare cost. Authors' overall conclusion supports welfare case, not proponent case.	Selectively cited by proponents
Tortora (1983)	I	Multi-stage avoidance protocol with e-collar negative reinforcement plus extensive +R, 36 dogs	Complex multi-stage protocol, not simple aversive. Author's own Experiment 3 undermines proponent reading. 1983, predates modern welfare measures.	Cited to argue e-collars resolve aggression
Lindsay (2005), Vol. 3	I	Textbook chapter expressing author's interpretation of training methodology	Not peer-reviewed welfare research. Characterization of low-level e-stim as non-aversive is contradicted by nociception science.	Cited as authority for low-level being benign
Group J. Foundational and Theoretical Works				
Mowrer (1947)	J	Theoretical paper introducing two-factor framework for avoidance learning	Avoidance learning involves two processes: Pavlovian fear conditioning to warning signal, plus operant negative reinforcement of the response that terminates the signal.	Foundational for why aversive-trained behaviors persist after equipment removal
Bandura (1965)	J	Experimental study of imitative learning under varying model-reinforcement contingencies	Observers acquire behavioral responses by watching models. Learning and performance are dissociable.	Foundational social-learning reference
Melzack & Wall (1965)	J	Theoretical paper introducing gate-control theory of pain	Pain signals can be modulated at the spinal cord level. Underlies analgesic mechanism of TENS units. Operates only at sub-nociceptive intensities.	"E-collars work like TENS" fails
Thompson & Spencer (1966)	J	Foundational characterization of habituation as a behavioral phenomenon across species	Habituation is the decrease in response to repeated biologically irrelevant stimuli. Stimuli with biological significance do not habituate.	"E-collar stim is just novel" fails

Author and Year	Grp	Design and Sample	Key Finding	Counters / Reading
Schenkel (1947)	J	Observational study of captive wolves at Zurich zoo during WWII	Captive-wolf observations describing competitive alpha struggles. Captive wolves from unrelated origins do not form natural social structures. Mech (1999, 2008) has retracted the extension to wild wolves and dogs.	Historical origin of dominance framing
Mech (1999)	J	Field-research synthesis from Mech, the wolf biologist whose 1970 book popularized the alpha-pack-leader framework	Wild wolf packs are family groups, not competitive struggles for alpha status. Mech distances himself from his own framework.	Closes dominance-theory rationalization
Mech (2008)	J	Public-facing essay restating retraction of alpha framework	Most prominent scientific advocate for alpha-pack-leader framework publicly retracted it in both formal and informal venues.	Closes dominance-theory rationalization for confrontational handling
Group K. Dog Training Adjacent Reviews and Welfare-Framework References				
Mellor et al. (2020)	K	Conceptual update of Five Domains welfare assessment framework, formally incorporating human-animal interactions	Five Domains Model is the contemporary scientific standard for welfare assessment. Human-animal interactions are a welfare domain.	Welfare-framework reference
Todd (2018)	K	Review and analysis of barriers to widespread adoption of humane dog training methods	Lack of trainer regulation is a structural cause of continued aversive-method use. Public information environment maintains use despite welfare evidence.	Supports policy argument for state licensure
Ziv (2017)	K	Systematic review of 17 peer-reviewed studies comparing training methods in dogs	No evidence positive punishment more effective than positive reinforcement. Aversive methods can jeopardize physical and mental health.	Single-citation review for comparative training-methods evidence

Bolded entries are the strongest single citations for each group: anchor studies that any practitioner should be able to name on demand. The convergence across groups (experimental, observational, survey, affective-state, mechanical, pain neuroscience, threat circuitry) is the structural feature of the evidence base; no single study carries the case alone, and the agreement across methodologies is what makes it convergent.

Group A. Controlled Experimental Studies of Aversive Equipment

Cooper, Cracknell, Hardiman, Wright, and Mills (2014)

Citation. The welfare consequences and efficacy of training pet dogs with remote electronic training collars in comparison to reward based training. PLOS ONE, 9(9), e102722. 10.1371/journal.pone.0102722

Design and sample. Randomized controlled study of 63 pet dogs referred for recall problems. Three groups: (1) industry-nominated trainers using e-collars, (2) the same trainers without e-collars, and (3) APDT-affiliated reward-based trainers. The industry-nominated trainers were nominated by the Electronic Collar Manufacturers Association as representing best practice.

Key findings. Dogs trained without e-collars achieved equivalent or better training outcomes. The e-collar group showed significantly elevated stress-related behaviors during training, including yawning, panting, and tense body posture. The cortisol comparison did not reach significance in the larger main study (the preliminary nine-dog phase did show elevation post-stimulation, but the larger phase did not replicate this clearly).

Proponent reading. The cortisol non-significance is sometimes cited to dismiss the welfare findings, and the comparison group differences in reinforcement rate are sometimes used to argue the comparison was unfair.

Response. Cortisol is one measure and a blunt one. Behavioral stress markers are validated welfare indicators on their own, and they reached significance. The reinforcement rate critique either concedes that the e-collar added no benefit (in which case it carried welfare cost for nothing) or reduces to a hypothetical about a better protocol that the industry-nominated trainers themselves did not deliver.

Deployment. This is the anchor study for the necessity claim against electronic collars. The argument is decisive: industry-nominated, manufacturer-endorsed best-practice trainers, working on the problems most favorable to the tool (recall and chasing), did not produce better outcomes than reward-based trainers, and produced welfare harm in the process.

Limits and honest acknowledgments. The cortisol finding is real and should be acknowledged. The honest framing is that cortisol can be suppressed, lagged, or buffered by context, and a single blunt physiological measure does not erase the validated behavioral stress findings. Dissociation between behavioral and physiological stress markers is a known feature of canine welfare research, not a flaw in this study.

China, Mills, and Cooper (2020)

Citation. Efficacy of dog training with and without remote electronic collars vs. a focus on positive reinforcement. Frontiers in Veterinary Science, 7, 508. 10.3389/fvets.2020.00508

Design and sample. Re-analysis and continued analysis of the Cooper 2014 dataset, focusing specifically on training efficacy across the three groups (industry e-collar trainers, same trainers without e-collars, reward-based trainers).

Key findings. Reward-based training achieved superior outcomes on multiple efficacy measures, including faster latency to sit, fewer hand and lead signals required, and faster general obedience progress. The e-collar group did not show better learning outcomes than the matched no-collar group operated by the same trainers.

Proponent reading. Sometimes ignored or dismissed as repackaging the Cooper data.

Response. It is intentional re-analysis of the same dataset focused on a different question (efficacy) than the welfare focus of the 2014 paper. The finding is decisive on the necessity claim: whatever benefit the industry-nominated trainers brought to the training was not coming from the collar, because the same trainers did not produce better outcomes when they had it.

Deployment. Use this study together with Cooper 2014 to close the necessity claim for electronic collars at the professional level. The combination tests the argument "these tools work in expert hands" directly, using the experts the industry put forward, and the argument fails.

Group B. Direct Observational and Clinical Studies

Schilder and van der Borg (2004)

Citation. Training dogs with help of the shock collar: Short and long term behavioural effects. Applied Animal Behaviour Science, 85(3-4), 319-334. 10.1016/j.applanim.2003.10.004

Design and sample. Behavioral observation study of protection-trained working dogs in guard-dog training programs (the published abstract describes the sample as German Shepherd dogs) during and after shock collar training, compared to matched dogs trained without shock.

Key findings. Shock-collar-trained dogs showed lower body postures, high-pitched yelps, avoidance behaviors, and other behavioral signs of fear and stress on shock application. Dogs that had received shocks showed more behavioral signs of fear and stress in the broader training context, even when no shock was being delivered, indicating a conditioned emotional response associated with the training context, the trainer, and the commands.

Deployment. This is the foundational study for conditioned emotional response to aversive training. Use it to counter the "the dog is fine when the collar is off" argument and to explain why aversive equipment produces welfare costs that persist beyond the moment of application.

Limits and honest acknowledgments. Working dog population, not pet dogs. Proponents will sometimes argue this limits generalizability to companion dog training. The honest acknowledgment is that the population is specific, but the underlying mechanism (conditioned emotional response to aversive stimuli) is general across mammalian learning, and the finding is corroborated by Vieira de Castro 2020 in pet populations.

Deldalle and Gaunet (2014)

Citation. Effects of 2 training methods on stress-related behaviors of the dog (Canis familiaris) and on the dog-owner relationship. Journal of Veterinary Behavior, 9(2), 58-65. 10.1016/j.jveb.2013.11.004

Design and sample. Direct observational study at two French training schools, one using negative reinforcement and one using positive reinforcement. Behavioral coding of dogs during training sessions.

Key findings. Dogs in the negative-reinforcement school showed significantly more stress-related behaviors and significantly less gaze toward the guardian during training compared to dogs in the positive-reinforcement school.

Deployment. Use this study to counter the "the dog looks happy and engaged" argument. The direct observational design rules out reliance on guardian self-report. The finding on guardian-directed gaze is particularly useful because it speaks to relationship quality, not just stress. Reduced guardian-directed gaze is one of the canonical behavioral indicators of insecure attachment and uncomfortable engagement with the handler.

Rooney and Cowan (2011)

Citation. Training methods and owner-dog interactions: Links with dog behaviour and learning ability. Applied Animal Behaviour Science, 132(3-4), 169-177. 10.1016/j.applanim.2011.03.007

Design and sample. Home-based observational study of 53 dog-guardian pairs, assessing training methods, dog learning ability on a novel task, and behavior problems.

Key findings. Dogs of guardians who reported using more physical punishment were less playful with their guardian and interacted less with the experimenter. Dogs of guardians who reported using more rewards performed better on a novel training task.

Deployment. Use this study to counter the "punishment teaches the dog faster" argument. The novel-task design rules out the possibility that reward-based dogs are simply better-trained on practiced behaviors; they perform better on a task they have not seen before, which is the actual measure of learning ability.

Herron, Shofer, and Reisner (2009)

Citation. Survey of the use and outcome of confrontational and non-confrontational training methods in client-owned dogs showing undesired behaviors. Applied Animal Behaviour Science, 117(1-2), 47-54. 10.1016/j.applanim.2008.12.011

Design and sample. Clinical referral survey of 140 client-owned dogs presenting to the University of Pennsylvania Veterinary Behavior Clinic, assessing training techniques previously used by guardians.

Key findings. Confrontational handling techniques produced aggressive responses at the following rates: hitting or kicking 43 percent, growling at the dog 41 percent, forcing the release of an item 39 percent, alpha roll 31 percent, staring the dog down 30 percent, dominance down 29 percent, grabbing jowls or scruff and shaking 26 percent, choke or pinch collar use 11 percent, and shock collar use 10 percent. Dogs presenting for aggression to familiar people were significantly more likely to respond aggressively to the alpha roll and to yelling "no."

Deployment. This is the anchor study for the confrontational handling argument. Use it to establish that techniques justified by dominance theory are clinically identified independent risk factors for guardian-directed aggression, and that they are particularly contraindicated for dogs already presenting with aggression.

Limits and honest acknowledgments. The study relies on guardian report of past technique use, which has known limitations (recall bias, social desirability bias). The clinical population is also self-selected for behavior problems. The honest framing is that these limits affect prevalence estimates, not the direction of the finding. Subsequent population-level work (Casey et al. 2014) using multivariable analysis confirmed the increased odds of family-member aggression in dogs trained with aversive methods.

Group C. Population-Level Survey Studies

Hiby, Rooney, and Bradshaw (2004)

Citation. Dog training methods: Their use, effectiveness and interaction with behaviour and welfare. Animal Welfare, 13(1), 63-69. 10.1017/S0962728600026683

Design and sample. Survey of 364 UK dog guardians assessing training methods, obedience ratings, and behavior problems.

Key findings. Reward-based methods correlated with higher reported obedience scores. Punishment-based methods correlated with significantly more behavior problems. The number of behaviors taught using rewards correlated with obedience; the number taught using punishment correlated with problem behaviors.

Deployment. Foundational early population-level study. Use it as the historical anchor: the survey-level association between aversive methods and worse behavioral outcomes has been documented in the literature for more than two decades.

Blackwell, Twells, Seawright, and Casey (2008)

Citation. The relationship between training methods and the occurrence of behavior problems, as reported by owners, in a population of domestic dogs. Journal of Veterinary Behavior, 3(5), 207-217. 10.1016/j.jveb.2007.10.008

Design and sample. Survey of 192 UK dog guardians assessing training methods and behavior problem occurrence.

Key findings. Guardians using punishment-based training reported significantly higher rates of behavior problems including aggression. The highest aggression scores were reported in dogs whose guardians combined positive reinforcement with positive punishment (the methodology often labeled "balanced").

Deployment. Use this study to counter the balanced training claim that mixing rewards with punishment produces moderate, considered training. The empirical finding is that the combination is associated with the highest aggression scores in this sample. Adding rewards to a punishment-based protocol does not neutralize the welfare or behavioral cost.

Arhant, Bubna-Littitz, Bartels, Futschik, and Troxler (2010)

Citation. Behaviour of smaller and larger dogs: Effects of training methods, inconsistency of owner behaviour and level of engagement in activities with the dog. Applied Animal Behaviour Science, 123(3-4), 131-142. 10.1016/j.applanim.2010.01.003

Design and sample. Survey of 1,276 Austrian dog guardians, with smaller and larger dogs analyzed separately.

Key findings. High-frequency aversive training correlated with increased aggression, excitability, and anxiety. Reward-based training correlated with higher obedience without those side effects. The pattern held across both smaller and larger dogs.

Deployment. Use this study to counter "this only applies to small dogs" or "this only applies to large dogs." The size-stratified analysis rules out the proponent escape route that breed or size moderates the welfare cost.

Blackwell, Bolster, Richards, Loftus, and Casey (2012)

Citation. The use of electronic collars for training domestic dogs: Estimated prevalence, reasons and risk factors for use, and owner perceived success as compared to other training methods. BMC Veterinary Research, 8, 93. 10.1186/1746-6148-8-93

Design and sample. Survey of 3,897 UK dog guardians focused specifically on electronic collar use.

Key findings. Electronic collar users reported lower training success than reward-based trainers for comparable problems. Guardian attendance at training classes and guardian gender were the strongest predictors of e-collar use, not dog characteristics.

Deployment. Use this study to counter the claim that e-collars are reserved for dogs that genuinely need them. Guardian characteristics (specifically, source of training advice or absence of advice) drive equipment selection more than dog characteristics. The tool is selected by the human, not chosen by the dog's problem.

Casey, Loftus, Bolster, Richards, and Blackwell (2014)

Citation. Human directed aggression in domestic dogs (Canis familiaris): Occurrence in different contexts and risk factors. Applied Animal Behaviour Science, 152, 52-63. 10.1016/j.applanim.2013.12.003

Design and sample. Population-level survey with multivariable analysis of risk factors for human-directed aggression in domestic dogs.

Key findings. Adjusted increased odds of family-member aggression in dogs whose guardians used aversive methods, after controlling for confounding variables.

Deployment. Use this study to corroborate Herron et al. (2009) at the population level. The Herron clinical data are sometimes critiqued for sample selection; the Casey 2014 multivariable population analysis answers that critique by reaching the same direction of finding with appropriate statistical controls.

Masson, Nigron, and Gaultier (2018b)

Citation. Questionnaire survey on the use of different e-collar types in France in everyday life with a view to providing recommendations for possible future regulations. Journal of Veterinary Behavior, 26, 48-60. 10.1016/j.jveb.2018.05.004

Design and sample. Survey of 1,251 French respondents about electronic collar use, including acquisition patterns, application contexts, and reported outcomes.

Key findings. Among e-collar users, 71.8 percent operated the equipment without professional advice. 75 percent had tried two or fewer alternative methods before reaching for the collar. 7 percent of dogs on which collars had been used presented with physical wounds.

Deployment. This is the anchor study for the real-world use argument. Use it to establish that the actual exposure profile in the population (lay use, minimal alternative-method exposure, documented physical wounds) is materially different from the experimentally idealized version of e-collar use that proponents reference. Policy that addresses only the idealized version ignores the version that exists in the marketplace.

Masson, de la Vega, Gazzano, Mariti, Pereira, Halsberghe, Leyvraz, McPeake, and Schoening (2018a)

Citation. Electronic training devices: Discussion on the pros and cons of their use in dogs as a basis for the position statement of the European Society of Veterinary Clinical Ethology. Journal of Veterinary Behavior, 25, 71-75. 10.1016/j.jveb.2018.02.006

Design and sample. Multi-author European review article assembling the welfare evidence and clinical considerations on electronic training devices, prepared as the evidence basis for the European Society of Veterinary Clinical Ethology position statement. Authored by veterinary behavior specialists across multiple European countries.

Key findings. Comprehensive review concluded that electronic training devices pose welfare risks not justified by efficacy data, that less intrusive methods are available for the same training and behavior modification objectives, and that the available peer-reviewed evidence supports formal professional opposition to their use.

Deployment. Use this paper as the European multi-country professional review companion to Masson 2018b's empirical French survey. Where 2018b documents how electronic collars are actually used in the consumer marketplace, 2018a documents the multi-country professional consensus that the equipment should not be used. Together they bracket the population-level case from both ends, the user-behavior end and the professional-opposition end.

Starinsky, Lord, and Herron (2017)

Citation. Escape rates and biting histories of dogs confined to their owner's property through the use of various containment methods. Journal of the American Veterinary Medical Association, 250(3), 297-302. 10.2460/javma.250.3.297

Design and sample. Survey of 974 US dog guardians comparing containment methods (electronic fence, physical fence, and tethering) and outcomes.

Key findings. Escape rates by containment method: electronic fence 44 percent, physical fence 23 percent, tethered 27 percent. Electronic fences did not produce a clear protective effect on bite or escape outcomes compared to physical fencing.

Deployment. Use this study to counter the "electronic containment improves safety" argument. Physical fencing outperforms electronic on the available data. This is also the best peer-reviewed reference for guardians weighing physical fencing against electronic boundary systems.

Limits and honest acknowledgments. The study is survey-based and relies on guardian self-report of escape and bite incidents. The honest framing is that the magnitude of the difference (44 percent versus 23 percent) is large enough to be informative even granting the limits of guardian recall, and the direction of the finding is the opposite of what the proponent reading would predict.

Group D. Affective-State, Cognitive Bias, and Attachment Studies

Vieira de Castro, Barrett, de Sousa, and Olsson (2019)

Citation. Carrots versus sticks: The relationship between training methods and dog-owner attachment. Applied Animal Behaviour Science, 219, 104831. 10.1016/j.applanim.2019.104831

Design and sample. Survey and observational study using a Strange Situation Procedure adapted for dogs to assess attachment patterns toward the guardian.

Key findings. Aversive-based training was associated with significantly weaker dog-guardian attachment compared to reward-based training. Secure attachment patterns were more consistently observed in reward-trained dogs.

Deployment. Use this study to counter the "aversive training builds respect" or "stronger relationship" claim. The Strange Situation Procedure is methodologically more rigorous than guardian self-report and is the standard tool in attachment research. Aversive methods produce weaker, not stronger, attachment.

Vieira de Castro, Fuchs, Morello, Pastur, de Sousa, and Olsson (2020)

Citation. Does training method matter? Evidence for the negative impact of aversive-based methods on companion dog welfare. PLOS ONE, 15(12), e0225023. 10.1371/journal.pone.0225023

Design and sample. Multi-measure welfare study of 92 pet dogs from 7 Portuguese training schools (3 reward-based, 4 aversive-based of which 2 were mixed and 2 were high-aversive). Behavioral observation, salivary cortisol, and cognitive bias testing.

Key findings. Dogs in aversive-based schools showed significantly more stress behaviors during training, significantly higher post-training cortisol, and significantly more pessimistic cognitive bias. Dogs in mixed-method schools also showed significantly more stress behaviors and panted more than reward-only schools, although the cortisol difference reached significance only for the high-aversive group.

Deployment. This is the strongest single welfare study because it combines behavioral, physiological, and affective-state measures and finds convergence across all three. Use it as the anchor for the argument that aversive training produces welfare cost across multiple independent indicators, not just one.

Limits and honest acknowledgments. The cognitive-bias finding was specific to the high-aversive group, with the mixed group showing behavioral and physiological cost but not the cognitive-bias effect at significance. Honest framing: the welfare cost is dose-dependent, with higher aversive exposure producing the broader pattern. This does not exonerate the mixed protocol; it locates the cognitive-bias effect at the highest exposure level.

Casey, Naj-Oleari, Campbell, Mendl, and Blackwell (2021)

Citation. Dogs are more pessimistic if their owners use two or more aversive training methods. Scientific Reports, 11, 19023. 10.1038/s41598-021-97743-0

Design and sample. Cognitive bias test (judgment bias paradigm) of 104 dogs across training method categories.

Key findings. Dogs trained with two or more aversive methods showed significantly more pessimistic cognitive bias than dogs trained with reward-based methods. Cognitive bias is a validated indicator of persistent affective state.

Deployment. Use this study to counter the "the welfare effect is short-term" or "the dog gets over it" argument. Cognitive bias measures persistent affective state outside the training context, meaning the welfare cost extends beyond the training session itself. This is also the cleanest demonstration that the cumulative-exposure argument is empirically supported.

Group E. Mechanical and Physical Effects (Neck-Pressure Equipment)

> *Important scope note. The studies in this group apply specifically to neck-pressure equipment (prong and choke collars). They do not apply to electronic collars, which operate by a different mechanism. The welfare case against electronic collars rests on nociception and threat-circuit engagement (Groups F and G), not on mechanical injury. Conflating the two arguments is a common practitioner mistake.*

Pauli, Bentley, Diehl, and Miller (2006)

Citation. Effects of the application of neck pressure by a collar or harness on intraocular pressure in dogs. Journal of the American Animal Hospital Association, 42(3), 207-211. 10.5326/0420207

Design and sample. Measurement of intraocular pressure in 51 eyes of 26 dogs while the dogs pulled against a collar or a harness.

Key findings. Intraocular pressure rose significantly from baseline when pressure was applied via a collar, but not when equivalent pressure was applied via a harness. The proposed mechanism is ventral neck pressure compressing the jugular veins and obstructing ocular aqueous outflow.

Deployment. Use this study to establish that ordinary collar use under pull produces measurable physiological consequences in healthy dogs, not only in dogs with pre-existing ocular disease. The study explicitly recommends harnesses over collars for dogs with weak or thin corneas, glaucoma, or any condition where elevated intraocular pressure could be harmful.

Limits and honest acknowledgments. The study tested flat collars, not prong or choke collars specifically. The honest framing is that prong and choke collars concentrate or constrict force in ways that flat collars do not, which on the underlying mechanism would be expected to produce equal or greater elevation. The peer-reviewed literature has not yet directly tested prong or choke collars against the same protocol, and the burden of demonstrating mechanical safety lies with the manufacturers, not with the welfare science community.

Carter, McNally, and Roshier (2020)

Citation. Canine collars: An investigation of collar type and the forces applied to a simulated neck model. Veterinary Record, 187(7), e52. 10.1136/vr.105681

Design and sample. Tested seven collar types and a slip lead on a simulated canine neck model with a pressure sensor beneath the collar. Force levels: firm pull (40 N), strong pull (70 N), and jerk (141 N average).

Key findings. Collars produced pressures between 83 and 832 kilopascals on the model neck. Collar type and applied force each had significant effects on the pressure delivered. The authors concluded that no collar tested produced a pressure low enough to mitigate the risk of injury when the dog pulls on the lead.

Deployment. Use this study to establish that the pressures produced by ordinary on-leash equipment, under pull forces representative of real-world handling, fall in injury-relevant ranges. The conclusion that no collar tested produces injury-mitigating pressures is decisive on the equipment-design question.

Limits and honest acknowledgments. Simulated neck model rather than live dogs. Some proponents will use this to dismiss the finding. Honest framing: the model standardizes the mechanical question (what pressure is delivered to the neck under specified force) in a way that live-dog measurement cannot. The mechanical finding is robust; what live-dog studies could add is biological response, not mechanical force calibration.

Hunter, Blake, and De Godoy (2019)

Citation. Pressure and force on the canine neck when exercised using a collar and leash. Veterinary and Animal Science, 8, 100082. 10.1016/j.vas.2019.100082

Design and sample. Measurement of force and pressure on the canine neck during ordinary on-leash walking using different collar constructions.

Key findings. Peak contact pressure reached 44.61 newtons per square centimeter, with significant differences in how different collar constructions transmit force to the neck.

Deployment. Use this study together with Carter 2020 to establish that ordinary collar use during ordinary walking transmits substantial pressure to the canine neck, not only during training corrections.

Grohmann, Dickomeit, Schmidt, and Kramer (2013)

Citation. Severe brain damage after punitive training technique with a choke chain collar in a German shepherd dog. Journal of Veterinary Behavior, 8(3), 180-184. 10.1016/j.jveb.2013.01.002

Design and sample. Peer-reviewed case report of a 1-year-old German Shepherd subjected to a punitive training technique in which the guardian lifted the dog off the ground by the choke chain.

Key findings. The dog initially appeared normal, then became progressively ataxic, began circling to the left, and showed reduced consciousness. Magnetic resonance imaging showed multifocal T2 and diffusion-weighted changes consistent with severe cerebral edema from ischemia. The injury mechanism was carotid artery compression producing cerebral hypoxia. Because of the severity of the neurological findings, the dog was euthanized.

Deployment. This is the documented case-report endpoint of the mechanical-injury argument. Use it to establish that punitive choke-chain techniques can produce fatal outcomes, not as a hypothetical risk but as a peer-reviewed clinical fact.

Limits and honest acknowledgments. Single case report. Proponents will sometimes argue this is unrepresentative. Honest framing: case reports do not establish prevalence; they establish that the injury mechanism is real and has been documented to produce the outcome of euthanasia. The peer-reviewed literature does not need additional cases to establish the mechanism.

Rozanski (2022)

Citation. Tracheal collapse. Today's Veterinary Practice, February 2022. todaysveterinarypractice.com/respiratory-medicine/tracheal-collapse

Design and sample. Clinical veterinary review of tracheal collapse in dogs.

Key findings. Repeated collar pressure is recognized in the clinical veterinary literature as a concern for tracheal collapse, and harnesses are commonly recommended in place of collars for dogs diagnosed with tracheal collapse. Cough induced by collar pressure is a recognized diagnostic feature of the condition in veterinary medicine.

Deployment. Use this clinical reference together with Pauli 2006, Carter 2020, and Hunter 2019 to establish that the recommendation to use a harness rather than a collar, particularly for dogs with diagnosed or suspected tracheal collapse, is mainstream veterinary clinical practice. This is not advocacy; it is standard of care.

Group F. Pain Neuroscience and Sensory Engagement

> *Important context note. The studies in this group support the welfare case at the level of biology. They establish that aversive training equipment crosses the nociceptive threshold by design, that the human and canine sensory anatomies are not equivalent, and that the relationship between user setting and delivered stimulus on a typical e-collar is not standardized in ways that would justify the proponent appeal to a low intensity setting. This group answers the proponent argument that low-level stimulation is mild, predictable, or comparable to a TENS unit at the level the argument is actually made: sensation severity, not tissue damage.*

Dubin and Patapoutian (2010)

Citation. Nociceptors: The sensors of the pain pathway. Journal of Clinical Investigation, 120(11), 3760-3772. 10.1172/JCI42843

Design and sample. Peer-reviewed review of nociceptor neurobiology in the Journal of Clinical Investigation.

Key findings. Nociceptors are specialized peripheral sensory neurons that detect potentially damaging stimuli at the skin, including extremes of temperature, pressure, chemical, and electrical signals, and transduce these stimuli into neural signals carried to higher brain centers. Critically, the system fires below the threshold of actual tissue injury. Its biological function is to warn the organism away from potentially harmful events before damage occurs.

Proponent reading. The proponent argument that low-level stimulation does not cause tissue damage and is therefore welfare-neutral assumes that nociception requires injury to engage. The neuroscience does not support that assumption.

Response. Nociceptors do not require tissue damage to fire. C-fiber and A-delta fiber nociceptors respond to electrical, mechanical, thermal, and chemical stimulation at intensities well below any injury threshold. The system exists precisely to warn the organism before damage occurs. A stimulus that crosses the nociceptive threshold engages the welfare-relevant neural machinery whether or not tissue damage results.

Deployment. Use this paper as the anchor reference for the nociception argument. The welfare case against aversive equipment does not require a showing of tissue damage. It rests on the biological reality that the equipment is functionally calibrated to deliver a stimulus the dog experiences as unpleasant enough to change its behavior, and unpleasant enough to change behavior through avoidance, escape, or suppression is, by definition, noxious.

Raja et al. (2020)

Citation. The revised International Association for the Study of Pain definition of pain: Concepts, challenges, and compromises. Pain, 161(9), 1976-1982. 10.1097/j.pain.0000000000001939

Design and sample. Revised International Association for the Study of Pain definition; published in Pain (the leading journal in the field), authored by the multidisciplinary IASP Task Force.

Key findings. Pain is defined as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage. The phrase "potential tissue damage" is intentional and core to the definition. The IASP also affirms that the definition applies to both human and nonhuman animals.

Proponent reading. Some proponent arguments equate "pain" with "tissue injury," treating the absence of injury as the absence of welfare cost.

Response. The international scientific definition of pain explicitly includes potential tissue damage. The phrase was added precisely because pain is a warning signal, not an injury report. A stimulus delivered at an intensity that the canine peripheral nervous system encodes as noxious meets the IASP definition of pain whether or not tissue damage follows.

Deployment. Pair this study with Dubin and Patapoutian (2010) when an opponent reduces the welfare argument to a tissue-damage argument. The international scientific definition is on the welfare side of the debate. The proponent reading conflicts with the consensus definition of the field that studies pain.

Affolter and Moore (1994)

Citation. Histologic features of normal canine and feline skin. Clinics in Dermatology, 12(4), 491-497. 10.1016/0738-081X(94)90215-1

Design and sample. Peer-reviewed review of histologic features of canine and feline skin in Clinics in Dermatology, organized by anatomic region.

Key findings. Canine haired-skin epidermis is approximately three to five cell layers thick, considerably thinner than human epidermis. The cutaneous structures that mediate nociception in dogs are anatomically distinct from human cutaneous anatomy.

Proponent reading. Self-test demonstrations on the human forearm, palm, or wrist are commonly cited by proponents to argue that low-level e-collar stimulation is a mild sensation and therefore welfare-neutral for dogs.

Response. Human and canine cutaneous anatomy are not equivalent. The same delivered electrical or mechanical energy will reach deeper structures in canine skin than it does in human skin, simply because the canine epidermis is a fraction of the thickness. A self-test that crosses the human nociceptive threshold at one intensity will reach deeper canine tissue at the same delivered energy. Self-testing on human skin systematically underestimates what the canine nervous system receives.

Deployment. Use this study whenever a proponent invokes a self-test demonstration on their own forearm or wrist as evidence that the stimulus is mild. The anatomical comparison is not in the proponent's favor.

Lines, van Driel, and Cooper (2013)

Citation. Characteristics of electronic training collars for dogs. Veterinary Record, 172(11), 288. 10.1136/vr.101144

Design and sample. Engineering measurement study of electrical characteristics of thirteen commercially available electronic training collar models in the United Kingdom; impedance measurements on twenty-seven dogs; published in the Veterinary Record.

Key findings. Stimulus energy at maximum settings ranged from 3.3 millijoules to 287 millijoules at a 50 kilohm load representative of canine neck impedance, an eighty-seven-fold range across products. Within a single collar, the median maximum-to-minimum energy ratio across the available strength settings was 81, with individual collars ranging from 8 to 1,114. Two of thirteen new collars examined contained manufacturing faults; in one case the collar could deliver a maximum-strength impulse regardless of the user's setting. The authors reported that user-disclosed comparison data such as voltage, pulse parameters, and waveform are not available at the point of sale. The authors concluded that a given strength setting cannot be assumed to deliver a similar stimulus across collar models or brands.

Proponent reading. Modern e-collars are commonly defended as operating at low stimulation levels, with skilled trainers using the minimum effective setting and the dog feeling something no worse than a tap on the shoulder.

Response. From the canine nervous system perspective, what determines whether the nociceptive threshold is crossed is the actual electrical signal at the skin, not the user's intensity setting. With an eighty-seven-fold range across products, an eighty-one-fold median ratio within products, manufacturing faults documented in two of thirteen new collars, and no point-of-sale disclosure of stimulus parameters, the proponent appeal to a low intensity setting, even granting good faith user technique, is not informative about the welfare-relevant question of whether the stimulus is noxious to the dog.

Deployment. This is the strongest single citation for the consumer-protection argument and for the "it's just a tingle on a low setting" rebuttal. The fact pattern, particularly the manufacturing-fault rate and the absence of point-of-sale disclosure, is also legislatively useful: it speaks directly to the regulatory vacuum and is the kind of evidence that lands with legislators evaluating consumer access.

Group G. Threat Circuitry, Controllability, and Avoidance Learning

> *Methodological framing note. The studies in Group G are not dog-training trials. They are mechanism evidence drawn from rodent research, human functional MRI, human behavioral testing, and broader mammalian threat, stress, controllability, and avoidance-learning literature. Their role is to explain the conserved threat, stress, controllability, and avoidance-learning mechanisms that operate across mammals. The dog-specific welfare evidence lives in Groups A through E. The cross-species evidence in Group G supports the dog-specific evidence at the mechanism level; it does not substitute for it. Folded interpretive notes (personal communications) appear at the end of the Limbachia (2021) and Wood (2014) profiles. These notes are interpretive support, not primary empirical evidence; they confirm the reading of the published studies. Both senior authors of the studies most often cited by proponents have explicitly disclaimed the proponent reading of their own work.*

LeDoux (2014)

Citation. Coming to terms with fear. Proceedings of the National Academy of Sciences, 111(8), 2871-2878. 10.1073/pnas.1400335111

Design and sample. Theoretical and review paper on the neuroscience of threat processing, fear conditioning, and the distinction between defensive-circuit activation and the conscious experience of fear.

Key findings. The amygdala and connected circuits respond to predicted aversive events, encoding threat associations and driving avoidance learning. LeDoux distinguishes defensive-circuit activation from the conscious experience of fear, but does not characterize circuit activation as welfare-neutral.

Deployment. Use this paper as the anchor reference for the threat-circuit argument. The neural circuitry that responds to aversive training events is the same circuitry that processes threat in mammalian models generally. This is not extrapolation; it is the core of the field.

Cain (2019)

Citation. Avoidance problems reconsidered. Current Opinion in Behavioral Sciences, 26, 9-17. 10.1016/j.cobeha.2018.09.002

Design and sample. Review of contemporary active avoidance research.

Key findings. Active avoidance is goal-directed instrumental behavior under threat. The shift from a fear state to an anxiety state during effective avoidance does not eliminate the underlying threat representation. The warning stimulus retains its conditioned threat value; what changes is that the animal has acquired a behavioral option that controls exposure to the aversive event. When the avoidance response is blocked or fails, the fear state returns along with the inflexible defensive reactions characteristic of fear.

Deployment. Use this paper to counter the "the dog looks calm and engaged during e-collar work, so the welfare cost is gone" argument. The contemporary fear-and-avoidance literature has moved beyond the older framing of avoidance as a reflexive, fear-driven response. Avoidance is goal-directed; the calm-looking dog is in an anxiety state mediated by an effective avoidance response, not in the absence of threat representation. The welfare cost is in the underlying threat representation that the warning stimulus retains throughout.

Maier and Watkins (2005)

Citation. Stressor controllability and learned helplessness: The roles of the dorsal raphe nucleus, serotonin, and corticotropin-releasing factor. Neuroscience and Biobehavioral Reviews, 29(4-5), 829-841. 10.1016/j.neubiorev.2005.03.021

Design and sample. Review of stressor controllability research integrating dorsal raphe, serotonergic, and corticotropin-releasing factor system findings across decades of work.

Key findings. Controllability modulates downstream consequences of aversive stressors but does not render the stressor benign or stress-free. The animal recruits stress-system machinery in response to controllable aversive events. What controllability attenuates is particular sequelae, including the spread of activation into prefrontal regions that produces the broader behavioral signature of learned helplessness.

Deployment. Use this paper to counter the "if the dog can control the aversive by behavioral compliance, the aversive is no longer welfare-relevant" argument. The neurobiological literature establishes a robust modulation finding: controllable aversive events produce a different downstream profile than uncontrollable aversive events. The work does not establish that controllable aversive events are stress-free or welfare-neutral. The aversive remains aversive.

Limbachia, Morrow, Khibovska, Meyer, Padmala, and Pessoa (2021)

Citation. Controllability over stressor decreases responses in key threat-related brain areas. Communications Biology, 4, 42. 10.1038/s42003-020-01537-5

Design and sample. Functional MRI study of human participants in conditions varying in controllability over aversive stimulation.

Key findings. When participants had control over aversive stimulation, the magnitude of threat-related neural responding was attenuated compared to uncontrollable aversive conditions, but not eliminated. The threat circuitry continues to respond; it responds less strongly.

Deployment. Use this study to address the proponent argument that controllability or predictability renders aversive stimulation welfare-neutral. The peer-reviewed neuroscience says attenuation, not elimination. Reduced response is not the absence of fear or stress.

Limits and honest acknowledgments. Human participants, not dogs. Proponents will sometimes argue this limits generalizability. Honest framing: the threat-circuit machinery (amygdala, ACC, periaqueductal gray, locus coeruleus) is conserved across mammals, and the principle of attenuation-without-elimination is the established finding in the field. The senior author has confirmed in writing that his research cannot be used to support the proponent reading (see folded interpretive note below).

Interpretive note (personal communication, not retrievable source). Dr. Pessoa, the senior author of Limbachia et al. (2021), confirmed in writing (L. Pessoa, personal communication, April 10, 2026) that the attenuation finding in this study should not be interpreted as rendering controllable aversive stimulation neurologically neutral or welfare-benign. Controllability reduces the magnitude of threat-related neural responding; it does not eliminate it. Use this interpretive note to settle disputes about Limbachia (2021) when the study is invoked in support of the controllability defense. The senior author has explicitly disclaimed the proponent interpretation. The empirical finding lives in the published study; this is interpretive support, not a new empirical claim, and the proponent reading conflicts with both the study and the senior author's own statement of how the study should be read.

Wood, Ver Hoef, and Knight (2014)

Citation. The amygdala mediates the emotional modulation of threat-elicited skin conductance response. Emotion, 14(4), 693-700. 10.1037/a0036636

Design and sample. Functional MRI and skin conductance study of threat-elicited responses and their emotional modulation in human participants.

Key findings. The amygdala mediates the emotional modulation of threat-elicited responses, situating the amygdala as the key node through which aversive stimulation produces emotional response.

Deployment. Use this paper together with Limbachia et al. (2021) to establish the neuroscientific foundation for the threat-circuit argument. The senior author has confirmed in writing that his research cannot be used to support the proposition that predictable aversive stimulation is neutral or benign (see folded interpretive note below).

Interpretive note (personal communication, not retrievable source). Dr. Knight, the senior author of Wood et al. (2014), confirmed in writing (D. C. Knight, personal communication, April 17, 2026) that his research, including the broader research program on conditioned diminution of unconditioned responses, cannot be used to support the proposition that predictable aversive stimulation is neurologically neutral or benign. Use this interpretive note together with the Pessoa note in the Limbachia (2021) profile to close the controllability and predictability defenses at the level of contemporary neuroscience. Both senior authors of the studies most often cited by proponents have explicitly disclaimed the proponent reading of their own work. The empirical finding lives in the published study; this is interpretive support, not a new empirical claim.

Sears, Andrade, Samels, Laughlin, Moloney, Wilson, Alwood, Moscarello, and Cain (2026)

Citation. Devaluation of response-produced safety signals reveals circuits for goal-directed versus habitual avoidance in dorsal striatum. Nature Communications, 17, 2542. 10.1038/s41467-026-69119-3

Design and sample. Shuttlebox active avoidance with rats; novel safety-signal devaluation procedure; chemogenetic suppression of dorsomedial and dorsolateral striatum; both sexes tested, with the devaluation effect reported in males.

Key findings. Active avoidance is positively reinforced by response-produced feedback cues that the brain transforms into safety signals through their inverse relationship with the aversive event. Moderately trained avoidance is goal-directed and depends on posterior dorsomedial striatum. Overtrained avoidance becomes habitual, depends on dorsolateral striatum, and is insensitive to safety-signal devaluation. The same overtrained-habit circuit is implicated in obsessive-compulsive disorder (Gillan et al., 2014) and in survivors of early life stress (Gordon et al., 2020).

Proponent reading. A sophisticated proponent argument runs that the dog's avoidance behavior in shock-collar training is positively reinforced by the safety signal (the absence of shock), and therefore the training is not actually aversive; the dog is working for safety, not avoiding pain.

Response. The argument inverts the structure of the learning architecture. Safety signals acquire their value entirely from their inverse relationship with the aversive contingency. Without the aversive event, no warning stimulus acquires threat value, no feedback cue acquires safety value, and the avoidance response is not reinforced. The aversive contingency is the precondition for the entire learning architecture. To describe avoidance as positively reinforced by safety, in the technical sense Sears and colleagues use, is not to claim that the underlying training regime was not aversive. Additionally, the same dorsolateral striatum-mediated habitual circuit is the substrate of clinically maladaptive avoidance in obsessive-compulsive disorder and in survivors of early life stress. The argument is not that aversive training causes obsessive-compulsive disorder in dogs. The argument is that the learning architecture aversive-based training depends on, particularly under prolonged or overtrained conditions, is the same architecture implicated in clinical populations as the substrate for persistent maladaptive avoidance.

Deployment. This is the strongest available counter to the most sophisticated proponent argument in current circulation. Use it together with Cain (2019) and the Limbachia/Pessoa and Wood/Knight pairs to close the controllability and predictability defenses at the level of contemporary neuroscience.

Christiansen, Bakken, and Braastad (2001)

Citation. Behavioural changes and aversive conditioning in hunting dogs by the second-year confrontation with domestic sheep. Applied Animal Behaviour Science, 72(2), 131-143. 10.1016/S0168-1591(00)00203-3

Design and sample. Field study of remote shock collar use in 114 hunting dogs (Norwegian elkhounds, English setters, and hare hunting dogs) across two consecutive years of pasture confrontation testing with sheep, under conditions designed to maximize controllability and predictability of the aversive stimulus.

Key findings. The authors' own welfare measures were limited, relying largely on guardian report and temperament tests, and the study did not detect a significant fear or anxiety effect using those measures.

Proponent reading. Sometimes invoked by proponents to argue that controllable, predictable shock-collar use in field conditions is welfare-benign.

Response. The methodological thinness of the welfare assessment, rather than a clean positive welfare conclusion, is what prevents the data set from supporting a welfare-benign reading. The study did not include physiological stress measures, did not include direct behavioral coding of stress markers, and did not include cognitive bias or other validated affective-state measures. Absence of evidence under thin measures is not evidence of welfare neutrality. The authors themselves recommend the device be used only for the specific purpose of preventing livestock attack, in connection with positive reinforcement, which is not how the equipment is sold or used in consumer markets.

Deployment. When this study is invoked, point to the methodological limits of the welfare assessment in the original paper, and to the authors' own restricted recommendation. Even granting the Christiansen finding for its specific specialized context, the finding does not transfer to consumer marketplace conditions.

Arnsten (2009)

Citation. Stress signalling pathways that impair prefrontal cortex structure and function. Nature Reviews Neuroscience, 10(6), 410-422. 10.1038/nrn2648

Design and sample. Review of stress-signaling pathways in mammalian prefrontal cortex, integrating cellular, molecular, and behavioral findings on how chronic and acute stress alters prefrontal structure and function.

Key findings. Stress exposure produces measurable changes in prefrontal cortex structure (dendritic remodeling, spine loss) and function (impaired working memory, impaired top-down behavioral control). The cellular mechanisms involve catecholamine signaling and glucocorticoid action on prefrontal neurons. Effects scale with cumulative exposure rather than single-session intensity.

Deployment. Use this paper to extend the welfare argument from acute single-session stress (which is the typical proponent reading of "the dog seemed fine after one session") to cumulative-exposure effects. The neurobiological literature establishes that prefrontal cortex changes accumulate with repeated stress exposure, not just with extreme single events. A policy framework that assesses aversive training equipment only on the basis of a single-session stress response is, on this evidence, assessing the wrong exposure window.

Vyas, Mitra, Shankaranarayana Rao, and Chattarji (2002)

Citation. Chronic stress induces contrasting patterns of dendritic remodeling in hippocampal and amygdaloid neurons. The Journal of Neuroscience, 22(15), 6810-6818. 10.1523/JNEUROSCI.22-15-06810.2002

Design and sample. Rodent neuroanatomical study of dendritic remodeling in hippocampal and amygdaloid neurons following chronic stress exposure. Cellular morphology assessment in stressed and control animals.

Key findings. Chronic stress produces opposite patterns of dendritic remodeling in two key brain regions. Hippocampal neurons show dendritic atrophy. Amygdaloid neurons show dendritic hypertrophy. Both changes are functionally significant and persist beyond the period of stress exposure. The amygdala becomes structurally primed to respond more strongly to future threat-related stimuli, while the hippocampus loses capacity for context-dependent regulation of fear responses.

Deployment. Use this paper to address the argument that the dog "will recover" or that the welfare cost ends when the training session ends. The structural neuroscience says the brain remodels under chronic stress in directions that increase, rather than decrease, future threat reactivity. Combine with Rosenkranz et al. 2010 and McEwen 2012 to support the argument that cumulative aversive exposure produces lasting structural changes in the threat-processing system.

Rosenkranz, Venheim, and Padival (2010)

Citation. Chronic stress causes amygdala hyperexcitability in rodents. Biological Psychiatry, 67(12), 1128-1136. 10.1016/j.biopsych.2010.02.008

Design and sample. Electrophysiological study of amygdala neuronal excitability in rodents following chronic stress exposure. Direct measurement of neural firing properties in stressed versus control animals.

Key findings. Chronic stress produces measurable hyperexcitability in amygdala neurons, meaning the cells fire more readily in response to subsequent stimuli. The effect persists beyond the immediate stress period. The amygdala becomes functionally primed to respond more strongly to threat-related cues following chronic stress exposure, consistent with the structural remodeling reported by Vyas et al. 2002.

Deployment. Use this paper as the functional companion to Vyas 2002. Where Vyas documents structural changes (dendritic hypertrophy in amygdala), Rosenkranz documents the functional consequence (cells fire more readily). The argument is direct: chronic aversive exposure does not just make the dog feel bad in the moment; it remodels the threat-processing system in directions that make the system more reactive to future threats. The welfare cost is cumulative and structural, not transient.

McEwen (2012)

Citation. Brain on stress: How the social environment gets under the skin. Proceedings of the National Academy of Sciences, 109(Suppl 2), 17180-17185. 10.1073/pnas.1121254109

Design and sample. Theoretical and review paper on the cumulative effects of chronic stress on brain and body, integrating findings across decades of work on hypothalamic-pituitary-adrenal axis function, allostatic load, and stress-related disease.

Key findings. Chronic stress produces cumulative effects on multiple body systems through the concept of allostatic load, the wear and tear that accumulates when the body's stress-response systems are repeatedly activated. Effects extend to cognitive performance, stress reactivity, affective state, and physical health. The framework distinguishes adaptive stress responses (which return to baseline) from maladaptive cumulative load (which does not).

Deployment. Use this paper for the cumulative-exposure argument at the level of integrative stress physiology. McEwen's allostatic load framework is the contemporary standard for thinking about chronic stress effects, and it directly addresses the proponent claim that single-session stress responses are the welfare-relevant measure. The framework says they are not. The welfare-relevant measure is cumulative load across repeated exposures, and that load has documented consequences for cognition, behavior, and health.

Gillan, Morein-Zamir, Urcelay, Sule, Voon, Apergis-Schoute, Fineberg, Sahakian, and Robbins (2014)

Citation. Enhanced avoidance habits in obsessive-compulsive disorder. Biological Psychiatry, 75(8), 631-638. 10.1016/j.biopsych.2013.02.002

Design and sample. Experimental study of avoidance habit formation in human participants with obsessive-compulsive disorder compared to healthy controls. Behavioral and computational measures of habitual versus goal-directed avoidance.

Key findings. Obsessive-compulsive disorder is associated with enhanced avoidance habits. Patients show stronger reliance on habitual avoidance responding even under conditions where the avoidance contingency has been changed or where flexible behavior would yield better outcomes. The dorsolateral striatum is implicated in this habitual avoidance circuit, the same neural substrate identified in Sears et al. 2026 for overtrained avoidance in animals.

Proponent reading. Sometimes treated as irrelevant to dog training because the patients are humans with a clinical disorder.

Response. The relevance is at the circuit level, not the diagnostic level. The argument is not that aversive-based training causes obsessive-compulsive disorder in dogs. The argument is that the learning architecture aversive-based training depends on, particularly under prolonged or overtrained conditions, recruits the same dorsolateral striatum-mediated habitual circuit that Gillan and colleagues implicate in obsessive-compulsive disorder. The convergence between the avoidance-learning literature in animals (Sears 2026), the clinical literature in humans (Gillan 2014), and the developmental literature on early-life stress (Gordon 2020) is the substantive finding.

Deployment. Use this paper as one of the three converging anchors (Sears 2026, Gillan 2014, Gordon 2020) for the argument that overtrained avoidance recruits a circuit implicated across animal, clinical-human, and developmental-human populations as the substrate for persistent maladaptive avoidance. The pattern of convergence across these methodologies is the substantive finding.

Gordon, Patterson, and Knowlton (2020)

Citation. Early-life stress is associated with a preponderance of habitual responding in a novel instrumental avoidance learning paradigm. Neurobiology of Learning and Memory, 175, 107316. 10.1016/j.nlm.2020.107316

Design and sample. Behavioral study of human participants with and without histories of early-life stress, tested on a novel instrumental avoidance learning paradigm. Measures of habitual versus goal-directed responding.

Key findings. Survivors of early-life stress show a preponderance of habitual responding on a novel avoidance task. The behavioral pattern is consistent with the signature of dorsolateral striatum-dependent habit learning that Gillan et al. (2014) implicate in obsessive-compulsive disorder, supporting the convergence with the Sears et al. (2026) animal-research finding.

Deployment. Use this paper as the developmental-stress companion to Gillan 2014 and the animal-research companion to Sears 2026. The three studies converge on a single substantive finding: the same dorsolateral striatum-mediated habitual avoidance circuit is implicated in animal overtraining, in clinical-population avoidance pathology, and in the lasting consequences of developmental stress. The convergence across these populations and methodologies is what carries the weight of the argument, not any single study in isolation.

Group H. The Contested Study

Johnson and Wynne (2024)

Citation. Comparison of the efficacy and welfare of different training methods in stopping chasing behavior in dogs. Animals, 14(18), 2632. 10.3390/ani14182632

Design and sample. Comparison of training methods for stopping predatory chasing behavior in dogs. The study examined a narrow problem profile under specific experimental conditions.

Key findings. The authors reported efficacy under specific protocol conditions for the e-collar training method. The study reaches a narrow efficacy conclusion under the specific protocol conditions tested. It does not establish necessity, welfare neutrality, or broad real-world superiority of e-collar training.

Proponent reading. Frequently cited as decisive evidence that electronic collars are necessary or uniquely effective for predatory chasing intervention, and sometimes extended into broader claims about e-collar superiority across training contexts.

Response. The study establishes narrow efficacy under specific protocol conditions, not necessity, welfare neutrality, or broad real-world superiority. Its protocol design has been challenged in the peer-reviewed literature by Bastos, Warren, and Krupenye (2025), with specific methodological concerns about the reward-based comparison condition, the duration of the training trial, and the baseline comparability of groups. The present author's separately published methodological critique (Bangura, 2025, SSRN) raises additional concerns about internal validity and generalizability to general pet dog populations. The authors' published response to Bastos (Johnson and Wynne, 2025) did not resolve the substantive methodological concerns about the original protocol. A single contested efficacy finding under narrow experimental conditions is not a foundation for policy that grants broad consumer access to a device whose mechanism engages nociception and threat circuitry.

Deployment. When this study is invoked, do not concede the proponent reading. Reframe to what the study actually establishes (narrow efficacy under specific conditions), reference the Bastos peer-reviewed critique, reference the SSRN methodological critique, and note that the authors' 2025 response did not resolve the substantive methodological concerns. The narrow efficacy finding does not extend to necessity, welfare neutrality, or broad real-world superiority, and the policy question is not whether the protocol can produce a behavioral outcome under tightly controlled conditions but whether the equipment should be available in the consumer marketplace where the protocol conditions are not present.

Bastos, Warren, and Krupenye (2025)

Citation. What evidence can validate a dog training method? Learning and Behavior, 53, 227-228. 10.3758/s13420-024-00658-9

Design and sample. Peer-reviewed methodological critique of Johnson and Wynne (2024).

Key findings. Identifies specific methodological concerns about the reward-based comparison condition, the duration of the training trial, and the baseline comparability of groups.

Deployment. Use this paper together with the Bangura (2025) SSRN methodological critique whenever Johnson and Wynne 2024 is invoked. The peer-reviewed critique establishes that the methodological concerns about Johnson and Wynne are not idiosyncratic; they are recognized in the literature.

Johnson and Wynne (2025) Authors' Response

Citation. Chasing solutions: A response to Bastos et al. (2024). Learning and Behavior. Advance online publication. 10.3758/s13420-025-00672-5

Design and sample. Authors' published response to Bastos, Warren, and Krupenye (2025).

Key findings. The response did not resolve the substantive methodological concerns raised by Bastos et al. about the original protocol.

Deployment. Mention the existence of the response when Johnson and Wynne 2024 is invoked, so that an opponent cannot claim the methodological concerns were addressed in print. They were not. Note that the published exchange between Bastos and Johnson/Wynne is fully available in the peer-reviewed literature; the methodological concerns survive the exchange.

Bangura (2025) SSRN Methodological Critique

Citation. A critical evaluation of Johnson and Wynne's (2024) methodology in comparison of the efficacy and welfare of different training methods in stopping chasing behavior in dogs. SSRN, posted February 24, 2025. 10.2139/ssrn.5154127

Design and sample. Separately published methodological critique by the present author.

Key findings. Raises additional concerns about internal validity and generalizability of Johnson and Wynne (2024) to general pet dog populations. Note that SSRN posting is preprint-style hosting; the critique is publicly available and citable but is not itself peer-reviewed.

Deployment. Use this critique alongside the Bastos peer-reviewed critique when Johnson and Wynne 2024 is invoked. The two critiques cover different methodological concerns and together provide a more complete account of why the study does not support the proponent reading.

Group I. Proponent-Cited Studies and How to Address Them

> *These are the studies most commonly cited by balanced trainers in defense of aversive equipment. The pattern across them is consistent: the proponent reading typically depends on selective extraction of a single finding from a larger study whose overall conclusions point in a different direction, extension of a narrow methodological finding into broad claims the study does not support, or citation of older work that predates contemporary canine welfare science methodology.*

Salgirli, Schalke, Boehm, and Hackbarth (2012)

Citation. Comparison of learning effects and stress between 3 different training methods (electronic training collar, pinch collar and quitting signal) in Belgian Malinois police dogs. Revue de Médecine Vétérinaire, 163(11), 530-535.

Design and sample. Compared three training methods for distraction-based training in 42 Belgian Malinois police dogs in Germany, with cortisol and behavioral measures recorded across three training sessions.

Key findings. The comparison was among three aversive interventions in working dog populations under trained-handler conditions.

Proponent reading. Cited to argue that electronic collar use produced less stress than pinch collar use, positioning electronic or pinch collars as welfare-acceptable.

Response. The comparison was among three aversive interventions, not against reward-based training. The study cannot establish welfare neutrality of any of the three. The relevant comparison for companion dog policy is aversive versus non-aversive, not e-collar versus pinch collar. The senior author Esther Schalke has been a public critic of electronic collar use in companion dog contexts; her broader research program supports the welfare case against aversive equipment.

Deployment. When this study is invoked, reframe the comparison. The study does not address whether aversive equipment is welfare-acceptable; it addresses whether one aversive method is less stressful than another. That is not the policy question.

Steiss, Schaffer, Ahmad, and Voith (2007)

Citation. Evaluation of plasma cortisol levels and behavior in dogs wearing bark control collars. Applied Animal Behaviour Science, 106(1-3), 96-106. 10.1016/j.applanim.2006.06.018

Design and sample. Evaluated plasma cortisol levels and behavior in 24 kennel dogs (8 per group) wearing electronic bark collars, citronella spray bark collars, or inactivated control collars across a structured exposure protocol.

Key findings. Under the specific test conditions (kennel dogs, brief structured exposure, plasma cortisol at scheduled intervals), cortisol elevation was modest.

Proponent reading. Cited to argue that bark collars do not significantly elevate cortisol above baseline and are therefore welfare-neutral.

Response. Cortisol is a single physiological measure of stress, not a comprehensive welfare assessment. Behavioral stress markers and cortisol do not always converge. Absence of cortisol evidence is not evidence of absence of welfare cost. The full set of behavioral, affective, and physiological measures is what welfare assessment requires.

Deployment. When this study is invoked, reframe to the broader welfare assessment standard. The Cooper 2014 study illustrates the same point in the e-collar context: a non-significant cortisol finding does not erase validated behavioral stress findings.

Schalke, Stichnoth, Ott, and Jones-Baade (2007)

Citation. Clinical signs caused by the use of electric training collars on dogs in everyday life situations. Applied Animal Behaviour Science, 105(4), 369-380. 10.1016/j.applanim.2006.11.002

Design and sample. Examined dogs trained with electronic collars under three conditions varying in predictability and contingency of stimulus delivery.

Key findings. All three groups experienced welfare cost, with the lower-contingency conditions showing the largest effects. The study's overall conclusion was that the variability of welfare risk across use conditions, combined with the difficulty of guaranteeing optimal contingency conditions in real-world use, argues against approving the equipment for general use.

Proponent reading. Cited selectively for the finding that dogs receiving stimulation under contingency-clear conditions showed less stress than dogs in lower-contingency conditions, and read as supporting controllable e-collar use as welfare-acceptable.

Response. Selective citation. The study's overall conclusion supports the welfare case, not the proponent case. The senior author Esther Schalke has been a public critic of electronic collar use. Controllability and predictability attenuate but do not eliminate threat-circuit engagement, as confirmed by L. Pessoa, personal communication, April 10, 2026.

Deployment. When this study is invoked, point to the authors' own conclusions and to the senior author's broader public position. Selective extraction of one sub-finding misrepresents what the paper actually argues.

Tortora (1983)

Citation. Safety training: The elimination of avoidance-motivated aggression in dogs. Journal of Experimental Psychology: General, 112(2), 176-214. 10.1037/0096-3445.112.2.176

Design and sample. Multi-stage avoidance-learning protocol involving electronic collar negative reinforcement combined with extensive positive reinforcement in 36 dogs the author defined as having avoidance-motivated aggression.

Key findings. Complex multi-stage process beginning with positive reinforcement training, using both play and choke collars in early stages, introducing a conditioned safety signal as a negative reinforcer, and reserving electronic stimulation for later stages. Tortora's own Experiment 3 within the same paper (full-intensity signaled shock used to punish aggression directly) showed that simple aversive use of the electronic collar produced only slight decreases in aggression.

Proponent reading. Cited to argue that electronic collar training resolves aggression and improves welfare.

Response. The protocol was not simple aversive conditioning; it was a complex multi-stage process that began with positive reinforcement. The study's own Experiment 3 undermines the proponent reading that simple aversive conditioning of aggressive behavior is effective. The study is from 1983, predating contemporary canine welfare science methodology by decades, with no behavioral welfare measures, no physiological measures, no follow-up assessment of conditioned emotional responses, and methodological standards that would not meet contemporary peer-review expectations.

Deployment. The convergent welfare evidence base from 2004 forward, using contemporary methodology, supersedes a methodologically thin 1983 design. Citing Tortora as evidence against current force-free aggression behavior modification asks practitioners to weigh a single 1983 multi-stage protocol study without modern welfare measures against forty years of subsequent peer-reviewed convergent welfare research.

Lindsay (2005), Handbook of Applied Dog Behavior and Training, Volume 3

Citation. Lindsay, S. R. (2005). Handbook of Applied Dog Behavior and Training, Volume 3: Procedures and Protocols. Blackwell Publishing. ISBN 978-0813807386.

Design and sample. Three-volume textbook on applied dog behavior and training. Volume 3 is on procedures and protocols.

Key findings. Lindsay defends electronic collar use and characterizes low-level electronic stimulation as a "pulsing tingling or tickling sensation" rather than a noxious event.

Proponent reading. Cited as authoritative support for the position that low-level electronic stimulation is not aversive.

Response. A textbook chapter expressing the author's interpretation of training methodology, not a peer-reviewed welfare research finding. Lindsay's characterization of low-level electronic stimulation has not been substantiated by peer-reviewed nociception research. Electrical stimulation strong enough to drive avoidance learning is, by functional definition, crossing the nociceptive threshold; the characterization of the same stimulation as a non-aversive sensation cannot be reconciled with the operant requirement that the stimulation function as an aversive event. See also Dubin and Patapoutian (2010), Raja et al. (2020), and Lines, van Driel, and Cooper (2013) in Group F.

Deployment. A textbook chapter expressing one author's interpretation is not a peer-reviewed welfare finding. The convergent welfare research catalogued in this playbook supersedes textbook interpretation when the two are in conflict.

Group J. Foundational and Theoretical Works

> *Important context note. The works in this group are foundational theoretical references that the policy paper draws on rather than primary welfare-evidence studies. They establish the conceptual framework within which the welfare evidence is read: two-factor avoidance learning theory (Mowrer), gate-control theory of pain (Melzack and Wall), habituation theory (Thompson and Spencer), and the wolf-pack-and-dominance literature that the paper uses to dismantle dominance-based justifications for aversive handling (Schenkel, Mech 1999, Mech 2008). Bandura 1965 supports the social-learning framing the paper uses for some of its discussion of behavior acquisition. Profiles in this group are necessarily briefer than profiles in Groups A through I, since the works do not present primary welfare findings; they support the theoretical and historical scaffolding of the case.*

Mowrer (1947)

Citation. On the dual nature of learning: A re-interpretation of "conditioning" and "problem-solving." Harvard Educational Review, 17, 102-148.

Design and sample. Theoretical paper introducing the two-factor (or two-process) framework for avoidance learning.

Key findings. Mowrer proposed that avoidance learning involves two interacting processes. First, the organism acquires a Pavlovian fear association to a warning signal that predicts an aversive event. Second, the organism operantly learns a response that terminates the warning signal, and this response is reinforced by the reduction of the conditioned fear (negative reinforcement). The framework explains why avoidance behaviors, once learned, are remarkably persistent and resistant to extinction. The dog continues to perform the avoidance response even when the original aversive contingency has been removed, because the response continues to be negatively reinforced by the termination of the conditioned fear signal.

Deployment. Use this paper as the foundational theoretical reference when explaining why electronic collar training and similar aversive-based avoidance training produces behaviors that persist long after the equipment is removed. The two-factor framework is the classical answer to the proponent argument that "the collar comes off and the dog is fine," and it is the theoretical basis for the conditioned emotional response findings in Schilder and van der Borg 2004 and Vieira de Castro 2020.

Bandura (1965)

Citation. Influence of models' reinforcement contingencies on the acquisition of imitative responses. Journal of Personality and Social Psychology, 1(6), 589-595. 10.1037/h0022070

Design and sample. Experimental study of imitative learning in human participants under varying model-reinforcement contingencies. Foundational paper in social learning theory.

Key findings. Observers acquire behavioral responses by watching models, and the consequences experienced by the model influence whether the observed behavior is later performed. The paper established empirically that learning and performance are dissociable, that observers can acquire information about a behavior without immediately performing it, and that the social-learning channel operates alongside direct operant conditioning.

Deployment. Use this paper as the foundational social-learning reference. It supports the argument that dogs and other social mammals acquire information about training contingencies not just through their own direct experience but also through observation of conspecifics and humans. The relevance to the welfare argument is indirect but important: the theoretical literature supports a broader account of how dogs learn than the strictly operant framework that proponents of aversive equipment sometimes invoke.

Melzack and Wall (1965)

Citation. Pain mechanisms: A new theory. Science, 150(3699), 971-979. 10.1126/science.150.3699.971

Design and sample. Theoretical paper introducing the gate-control theory of pain.

Key findings. Pain signals traveling from the body to the brain can be modulated, dampened, or blocked at the level of the spinal cord. Two kinds of nerve fibers feed into a gate in the dorsal horn of the spinal cord. Large-diameter A-beta fibers carry harmless touch and vibration information and tend to close the gate. Smaller-diameter A-delta and C fibers carry nociceptive information and tend to open the gate. The framework explains why non-painful sensory input can modulate the transmission of pain signals, and underlies the mechanism by which therapeutic transcutaneous electrical nerve stimulation (TENS) units produce analgesia.

Proponent reading. The TENS-and-shock-collar comparison is sometimes invoked: "a shock collar is just a TENS unit, and TENS is therapeutic, therefore the collar is not aversive."

Response. The TENS modality the shock-collar analogy usually invokes is conventional sensory-level TENS, calibrated below the nociceptive threshold and primarily associated with A-beta fiber activation. Other TENS modalities exist and may recruit smaller-diameter fibers, but those are not the comparator that proponents typically have in mind. Conventional sensory-level TENS produces analgesia through gate-modulation at sub-nociceptive intensities. Stimulation strong enough to drive avoidance learning, by contrast, must engage A-delta and C fibers at intensities above the nociceptive threshold; otherwise the stimulation would not be behaviorally aversive and would not produce avoidance. The TENS-and-shock-collar comparison, in the form proponents usually invoke, fails because the two devices are designed to engage opposite ends of the nociceptive spectrum.

Deployment. Use this paper as the foundational theoretical reference for the TENS-versus-shock-collar distinction. Combine with Dubin and Patapoutian 2010 and Lines, van Driel, and Cooper 2013 from Group F to address the TENS comparison directly. The gate-control mechanism is real, it is the basis of legitimate therapeutic electrical stimulation, and it is incompatible with the aversive-control mechanism by which shock collars work.

Thompson and Spencer (1966)

Citation. Habituation: A model phenomenon for the study of neuronal substrates of behavior. Psychological Review, 73(1), 16-43. 10.1037/h0022681

Design and sample. Foundational theoretical and experimental characterization of habituation as a behavioral phenomenon, integrating findings across multiple species and stimulus modalities.

Key findings. Habituation is the progressive decrease in behavioral response to a repeated, biologically irrelevant stimulus. The phenomenon is documented across species and stimulus types. A merely novel or surprising stimulus, in the absence of biological significance, produces a response that habituates with repeated exposure. Stimuli that retain biological significance (such as those that signal threat or reward) do not habituate in the same way.

Deployment. Use this paper to address the proponent argument that electronic collar stimulation is "just novel" or that the dog "gets used to it." If the stimulation were merely novel and biologically irrelevant, the dog's response would habituate, and the equipment would stop working with repeated use. The fact that electronic collar stimulation continues to drive behavioral modification across hundreds of trials, without habituating away, is itself evidence that the stimulation retains biological significance, that is, it remains aversive. Habituation theory predicts that aversive stimuli, unlike merely novel ones, do not extinguish through repetition alone.

Schenkel (1947)

Citation. Expression studies of wolves. Behaviour, 1(2), 81-129. 10.1163/156853948X00065

Design and sample. Observational study of social behavior in captive wolves at the Zurich zoo, conducted during World War II.

Key findings. Schenkel observed unrelated, captive wolves and described what he interpreted as competitive struggles for "alpha" status, including assertive postures, dominance displays, and forced submission rituals. The captive-wolf social structure he described was extrapolated to wild wolves and, decades later, to domestic dogs.

Proponent reading. Frequently invoked, often indirectly, as the historical foundation for dominance-based dog training. The "alpha roll," "pack leader," and "dominance correction" framing for confrontational handling techniques traces to Schenkel's framework as popularized by L. David Mech's 1970 book on wolf ecology.

Response. Captive wolves brought together from unrelated origins do not form natural social structures. Wild wolf packs are family groups, and the social dynamics in family groups are not competitive struggles for alpha status. Mech himself, who popularized the alpha-pack-leader framing in his 1970 book, has since publicly retracted this characterization in the peer-reviewed literature (Mech 1999) and in subsequent public statements (Mech 2008). Contemporary canine ethology does not support the use of dominance-based confrontational handling techniques.

Deployment. Cite this paper to acknowledge the historical origin of the dominance framing while noting that the framework was based on captive-animal observations that have not held up in wild-wolf and family-group studies, and that Mech, the most prominent popularizer of the framework, has explicitly retracted it. Combine with Mech 1999 and Mech 2008 to close the dominance-theory rationalization for confrontational handling.

Mech (1999)

Citation. Alpha status, dominance, and division of labor in wolf packs. Canadian Journal of Zoology, 77(8), 1196-1203. 10.1139/z99-099

Design and sample. Field-research synthesis from L. David Mech, the wolf biologist whose 1970 book popularized the alpha-pack-leader framework. Based on extended field study of wild wolf packs.

Key findings. Wild wolf packs are family groups consisting of breeding adults and their offspring. The social dynamics in family groups are based on parental relationships and division of labor, not on competitive struggles for alpha status. The alpha-pack-leader framework derived from Schenkel's 1947 captive-wolf observations does not describe the social structure of wild wolves, and Mech explicitly distances himself from the framework that his own 1970 book had popularized.

Deployment. Cite this paper to establish that the alpha-pack-leader framework, the historical justification for many dominance-based dog training techniques, has been retracted by its most prominent popularizer in the peer-reviewed wolf biology literature. The dominance framework that justifies alpha rolls, dominance downs, and similar confrontational handling techniques does not have wild-wolf ethology behind it. Combine with Schenkel 1947 and Mech 2008 to close the dominance-theory rationalization.

Mech (2008)

Citation. Whatever happened to the term alpha wolf? International Wolf, 18(4), 4-8. wolf.org/wp-content/uploads/2013/09/267alphalegend.pdf

Design and sample. Public-facing essay by L. David Mech for the International Wolf Center publication, restating and elaborating the retraction of the alpha framework that Mech had developed in the peer-reviewed literature in 1999.

Key findings. Mech explains in plain language why he no longer uses the term "alpha" to describe wolf social structure. The captive-animal origin of the framework, the family-group structure of wild wolf packs, and the inappropriate extension of the framework to domestic dogs are all addressed. Mech states publicly that the alpha framework as commonly understood is incorrect.

Deployment. Cite this paper alongside Mech 1999 when the dominance-theory framework is invoked. Mech 2008 is the more accessible public-facing version of the retraction; Mech 1999 is the peer-reviewed version. Together they establish that the most prominent scientific advocate for the alpha-pack-leader framework has publicly retracted it in both formal and informal venues. The dominance-theory rationalization for confrontational handling does not survive contact with current wolf-biology literature.

Group K. Dog Training Adjacent Reviews and Welfare-Framework References

Mellor, Beausoleil, Littlewood, McLean, McGreevy, Jones, and Wilkins (2020)

Citation. The 2020 Five Domains Model: Including human-animal interactions in assessments of animal welfare. Animals, 10(10), 1870. 10.3390/ani10101870

Design and sample. Conceptual update of the Five Domains welfare assessment framework, incorporating human-animal interactions as a substantive domain alongside nutrition, environment, health, and behavior.

Key findings. The 2020 update of the Five Domains Model formally incorporates human-animal interactions as a welfare domain, recognizing that the quality of the human-animal relationship is a substantive welfare consideration in companion animals. The framework is the contemporary scientific standard for welfare assessment, having largely replaced the older Five Freedoms framework. Welfare assessment under the Five Domains Model evaluates the animal's state across all five domains and recognizes that negative experiences in one domain can persist as affective states that color experience in other domains.

Deployment. Use this paper as the contemporary welfare-assessment framework reference when an opponent asks what "welfare" means in the technical sense, or when the welfare argument needs to be grounded in the standard scientific framework rather than presented as the author's preferred view. The Five Domains Model is the framework that the convergent welfare evidence in Groups A through G is best understood within. The argument that aversive training equipment imposes welfare costs is the argument that aversive equipment produces negative experiences across multiple Five Domains domains, including the human-animal interaction domain explicitly added in the 2020 update.

Todd (2018)

Citation. Barriers to the adoption of humane dog training methods. Journal of Veterinary Behavior, 25, 28-34. 10.1016/j.jveb.2018.03.004

Design and sample. Review and analysis of barriers to widespread adoption of humane dog training methods by the general public. Identifies structural, informational, and regulatory factors that maintain the continued use of aversive methods despite the convergent welfare evidence.

Key findings. Multiple structural barriers maintain aversive training method use. Lack of public knowledge about welfare risks, poor quality of information available to guardians, lack of regulation of dog trainers, and inconsistent positions among professional bodies all contribute. The absence of dog trainer regulation is identified as a particularly significant structural barrier, since it allows aversive-method practitioners to operate without standards-of-practice constraints that would apply in regulated welfare-affecting professions such as veterinary medicine or mental health counseling.

Deployment. Use this paper to support the policy argument for state licensure of dog trainers, which is one of the two components of the policy recommendation in the main paper. Todd's analysis identifies the regulatory vacuum as a structural cause of continued aversive-method use, and the licensure proposal in the policy paper is the direct policy response to that diagnosis. Useful in legislative testimony when the licensure proposal is questioned, since it provides a peer-reviewed citation for the structural argument.

Ziv (2017)

Citation. The effects of using aversive training methods in dogs, A review. Journal of Veterinary Behavior, 19, 50-60. 10.1016/j.jveb.2017.02.004

Design and sample. Systematic review of seventeen peer-reviewed studies comparing training methods in dogs, focused on the effects of aversive training methods on behavior, welfare, and the human-animal relationship.

Key findings. Across the seventeen studies reviewed, no evidence was found that positive punishment is more effective than positive-reinforcement-based training. The reviewed evidence supported the conclusion that aversive methods can jeopardize dogs' physical and mental health. Welfare costs documented across the reviewed studies include stress-related behaviors, conditioned emotional responses, weakened dog-guardian relationships, and increased risk of aggression.

Deployment. Use this paper as a single-citation review when an opponent asks for one source that summarizes the comparative training-methods evidence. Ziv 2017 covers seventeen peer-reviewed studies and reaches the same convergent conclusion that the longer per-study analysis in this playbook supports. Useful in continuing-education contexts and in shorter advocacy correspondence where a single review citation is more practical than a list of seventeen primary studies.

Closing Notes on Deployment

The pattern across the studies in this playbook supports a single conclusion: convergent welfare evidence across multiple methodologies, populations, countries, and outcome measures favors the force-free position. The case does not depend on any individual study being unimpeachable. It depends on the agreement across studies being robust, which it is. The pattern is sufficiently convergent to support precautionary welfare policy.

When a critic attacks any single study in this playbook, the response is the same: the case is not built on this study alone. Use the convergence frame, name the other studies that point in the same direction, and let the critic explain why the same welfare signal would appear across so many independent methods by coincidence.

When a critic invokes a proponent-cited study from Group I, do not concede the proponent reading. Each of those studies, on careful examination, supports a narrower conclusion than the proponent reading attributes to it, and several actually support the welfare case against aversive equipment when read in their entirety.

Folded interpretive notes (personal communications from the senior authors of Limbachia 2021 and Wood 2014) appear at the end of those two profiles. These notes are interpretive support, not primary empirical evidence. Their value is that the senior authors of the studies most often cited by proponents have explicitly disclaimed the proponent reading of their own work.

The pain neuroscience studies in Group F (Dubin and Patapoutian 2010, Raja et al. 2020, Affolter and Moore 1994, Lines van Driel and Cooper 2013) answer the proponent argument at the level the argument is actually made: sensation severity rather than tissue damage. Use them when an opponent reduces the welfare argument to an injury argument, or when an opponent invokes a self-test on the human forearm, or when an opponent appeals to the user's low intensity setting on the dial.

The expanded threat-circuitry studies in Group G (Cain 2019, Maier and Watkins 2005, Sears et al. 2026 in rats) answer the most sophisticated proponent argument in current circulation: the claim that controllable, predictable aversive stimulation is welfare-neutral or that successful avoidance-trained dogs have transcended the aversive contingency. They have not. The aversive contingency is the precondition for the entire learning architecture, and overtrained avoidance recruits the same dorsolateral striatum circuit implicated in obsessive-compulsive disorder and in survivors of early life stress.

Table B. Quick-Reference Deployment Summary

This table is built for live deployment. Use it during preparation for podcasts, written exchanges, or formal debate to identify which studies to cite for a specific argument. The Strongest Argument column names the single most powerful argument each study supports.

Author and Year	One-Line Deployment	Strongest Argument It Supports
Anchor Studies (Should be in pocket at all times)		
Cooper et al. (2014)	Industry-nominated e-collar trainers produced welfare cost without training advantage over reward-based.	Necessity claim fails at the professional level.
China, Mills, & Cooper (2020)	Re-analysis confirming reward-based trainers achieved equivalent or better outcomes more efficiently.	E-collars are not faster or more effective.
Vieira de Castro et al. (2020)	Multi-measure welfare convergence (behavioral, cortisol, cognitive bias) in pet population.	Welfare cost across multiple independent indicators, not just one.
Casey et al. (2021)	Pessimistic cognitive bias in dogs trained with two or more aversive methods.	Welfare cost is persistent affective state, not transient.
Herron et al. (2009)	Confrontational handling techniques elicited aggression in 26 to 43% of dogs in clinical referral data.	Confrontational handling is contraindicated, not benign.
Lines, van Driel, & Cooper (2013)	87-fold range across e-collars, 81x median ratio within collars, 2 of 13 manufacturing faults.	"Low setting is mild and predictable" fails. Consumer-protection anchor.
Sears et al. (2026)	Safety signals acquire value only from the aversive contingency; overtrained avoidance recruits OCD circuit.	Closes the "safety reinforcement makes it positive" argument.
Convergence Studies (Reinforce the Anchors)		
Schilder & van der Borg (2004)	Stress responses persisted in non-training contexts; conditioned emotional response to handler and environment.	"Dog is fine when collar is off" fails.
Deldalle & Gaunet (2014)	Direct observational coding showing more stress and less guardian gaze in negative-reinforcement school.	"Dog looks happy and engaged" fails.
Vieira de Castro et al. (2019)	Strange Situation Procedure showing weaker dog-guardian attachment under aversive training.	"Aversive builds respect or relationship" fails.
Rooney & Cowan (2011)	Punishment predicted lower learning ability on novel tasks.	"Punishment teaches faster" fails.
Hiby et al. (2004)	Reward correlated with obedience; punishment correlated with behavior problems.	Foundational early survey-level finding.
Blackwell et al. (2008)	Mixed reward+punishment associated with highest aggression scores.	"Balanced is moderate" fails.
Arhant et al. (2010)	Punishment correlated with aggression, excitability, anxiety in both small and large dogs.	"Size moderates the effect" fails.
Blackwell et al. (2012)	E-collar use predicted by user characteristics, not dog characteristics. Lower training success reported.	"I only use these on dogs that need them" fails.
Casey et al. (2014)	Multivariable analysis: increased odds of family-member aggression with aversive methods.	Corroborates Herron at population level.
Masson et al. (2018b)	French e-collar users: 71.8% no professional advice; 7% of dogs with physical wounds.	"Professionals use these properly" fails. Real-world use compounds harm.

Author and Year	One-Line Deployment	Strongest Argument It Supports
Masson et al. (2018a)	European multi-author review forming basis of European Society of Veterinary Clinical Ethology position. Concluded e-collars not justified by evidence.	Multi-country professional review opposes e-collars.
Starinsky, Lord, & Herron (2017)	Electronic fence escape rate 44% vs physical fence 23%; no clear protective effect.	"Electronic containment improves safety" fails.
Mechanical Injury (Prong and Choke Collars Only)		
Pauli et al. (2006)	Intraocular pressure rises significantly with collar pulling, not with harness.	Ordinary collar use under pull produces measurable physiological harm.
Carter et al. (2020)	No collar tested produced injury-mitigating pressures under realistic pull forces.	Closes "ordinary collar use is mechanically safe" claim.
Hunter et al. (2019)	Substantial pressure transmitted to canine neck during ordinary on-leash walking.	Establishes baseline pressure during everyday handling.
Grohmann et al. (2013)	Peer-reviewed case report: fatal cerebral ischemia from punitive choke-chain hanging.	Documented fatal outcome from choke-chain technique.
Rozanski (2022)	Clinical veterinary recognition that repeated collar pressure is a tracheal collapse concern; harness recommended.	Standard of care supports harness over collar for affected dogs.
Pain Neuroscience and Sensory Engagement		
Dubin & Patapoutian (2010)	Nociceptors fire below the threshold of tissue injury; their function is to warn before damage.	"No tissue damage means no welfare cost" fails.
Raja et al. (2020)	IASP definition of pain explicitly includes potential tissue damage; applies to nonhuman animals.	"Pain requires tissue damage" fails.
Affolter & Moore (1994)	Canine epidermis 3-5 cell layers thick, considerably thinner than human.	"Self-test on human skin proves it's mild" fails.
Lines, van Driel, & Cooper (2013)	87-fold range across collars; 81x median ratio within collars; 2 of 13 faults; no point-of-sale disclosure.	"A low setting is mild and predictable" fails. Consumer-protection anchor.
Threat Circuitry, Controllability, Avoidance Learning		
LeDoux (2014)	Threat-circuit machinery is conserved across mammals; circuit activation is not welfare-neutral.	Foundational reference for the neuroscience argument.
Cain (2019)	Active avoidance is goal-directed under threat; calm-looking dog is in anxiety state, not absence of threat.	"Calm-looking dog is welfare-neutral" fails.
Maier & Watkins (2005)	Controllability modulates downstream consequences but does not render the stressor benign.	"Controllable aversive is welfare-neutral" fails.
Limbachia et al. (2021)	Controllability attenuates threat-related neural responding but does not eliminate it.	"Controllability makes aversive use safe" fails.
Wood, Ver Hoef, & Knight (2014)	Amygdala mediates emotional modulation of threat-elicited responses.	Anchors the threat-circuit argument.

Author and Year	One-Line Deployment	Strongest Argument It Supports
Sears et al. (2026)	Safety signals acquire value only from aversive contingency; overtrained avoidance recruits OCD circuit.	"Safety reinforcement makes it positive" fails.
Christiansen et al. (2001)	Welfare measures methodologically thin; absence of effect under thin measures is not welfare neutrality.	"Controllable, predictable shock-collar use is welfare-benign" fails.
L. Pessoa, personal communication, April 10, 2026	Senior author confirmed in writing his research does not support proponent reading on controllability.	Settles interpretive dispute. Interpretive support, not new empirical evidence.
D. C. Knight, personal communication, April 17, 2026	Senior author confirmed in writing his research cannot support "predictable aversive is benign."	Settles interpretive dispute. Interpretive support, not new empirical evidence.
Stress Neuroscience and Cumulative Exposure		
Arnsten (2009)	Stress signaling pathways impair prefrontal cortex structure and function; effects scale with cumulative exposure.	Cumulative-exposure framing. Single-session stress response is wrong measurement window.
Vyas et al. (2002)	Chronic stress produces opposite remodeling in hippocampus and amygdala; brain structurally primed for stronger future threat responding.	Welfare cost remodels brain in directions that increase future threat reactivity.
Rosenkranz, Venheim, & Padival (2010)	Chronic stress produces measurable amygdala hyperexcitability; effect persists beyond stress period.	Functional companion to Vyas 2002. Cumulative welfare cost is structural.
McEwen (2012)	Cumulative effects of chronic stress through allostatic load. Adaptive stress responses return to baseline; cumulative load does not.	"Single-session stress is what counts" fails. Cumulative load is welfare-relevant.
Gillan et al. (2014)	Enhanced avoidance habits in OCD; dorsolateral striatum implicated, same circuit as Sears 2026.	Clinical-population convergence with overtrained avoidance circuit.
Gordon, Patterson, & Knowlton (2020)	Survivors of early-life stress show enhanced habitual responding on novel avoidance task; same dorsolateral striatum circuit as Sears 2026 and Gillan 2014.	Convergence across animal, clinical-human, and developmental-human populations.
The Contested Study		
Johnson & Wynne (2024)	Narrow efficacy under specific protocol conditions, NOT necessity, welfare neutrality, or broad real-world superiority.	Reframe; reference Bastos peer-reviewed critique and Bangura SSRN critique.
Bastos et al. (2025)	Peer-reviewed methodological critique of Johnson & Wynne.	Anchor for rebutting Johnson & Wynne.
Foundational and Theoretical Works		
Mowrer (1947)	Two-factor avoidance learning framework. Pavlovian fear conditioning + operant negative reinforcement.	Theoretical foundation for why aversive-trained behaviors persist after equipment removal.
Bandura (1965)	Foundational social learning theory paper. Imitative learning, model-reinforcement contingencies.	Theoretical foundation for broader account of how dogs learn.

Author and Year	One-Line Deployment	Strongest Argument It Supports
Melzack & Wall (1965)	Gate-control theory of pain. Underlies analgesic mechanism of TENS; operates only at sub-nociceptive intensities.	"E-collars are like TENS" fails. Different ends of the nociceptive spectrum.
Thompson & Spencer (1966)	Habituation theory: biologically irrelevant stimuli habituate; biologically significant ones do not.	"E-collar stim is just novel" fails.
Schenkel (1947)	Captive-wolf observational study popularized as basis for alpha-pack-leader dominance framing.	Historical origin of dominance framing; contemporary canine ethology does not support it.
Mech (1999)	Wild wolf packs are family groups, not alpha-status struggles. Mech retracts his own 1970 framework.	Closes alpha-pack-leader framework in peer-reviewed wolf biology.
Mech (2008)	Public-facing essay restating retraction of alpha-pack-leader framework.	Closes dominance-theory rationalization for confrontational handling.
Dog Training Adjacent Reviews and Welfare Frameworks		
Mellor et al. (2020)	Five Domains welfare assessment framework, including human-animal interactions as a domain.	Welfare-framework reference. Standard scientific assessment framework.
Todd (2018)	Barriers to humane training adoption: lack of regulation, poor information, inconsistent professional positions.	Supports state licensure proposal in policy paper.
Ziv (2017)	Systematic review of 17 studies. No evidence punishment more effective than reward; aversive methods jeopardize physical and mental health.	Single-citation review of comparative training-methods evidence.

> *Bolded entries are the strongest single citations for live deployment. The Pessoa and Knight personal communications are interpretive support, not primary empirical evidence; their value is that the senior authors of the published studies have explicitly disclaimed the proponent reading.*

Table C. Argument-to-Studies Index

This table reverses the lookup direction. Instead of asking what does this study show, it answers what study do I need for this argument. Use it when an opponent makes a specific claim and you want to find the citations that counter it most directly.

Argument or Objection	Studies That Counter It
"You are cherry-picking studies"	Convergence across all studies in Groups A through G: Cooper 2014, China 2020, Vieira de Castro 2020, Casey 2021, Schilder & van der Borg 2004, Herron 2009, Blackwell 2008, Hiby 2004, Arhant 2010, Limbachia 2021, plus mechanical literature, plus pain neuroscience (Dubin & Patapoutian 2010, Raja 2020, Affolter & Moore 1994, Lines 2013), plus expanded threat circuitry (Cain 2019, Maier & Watkins 2005, Sears 2026).

Argument or Objection	Studies That Counter It
"Cortisol was not significant in Cooper 2014"	Cooper 2014 (behavioral stress markers reached significance); Vieira de Castro 2020 (cortisol elevation reached significance); Casey 2021 (cognitive bias finding).
"E-collars are necessary or unique for difficult cases"	Cooper 2014; China 2020; ACVB clinical practice (treats severe cases without aversive equipment).
"Professionals can use these tools safely"	Cooper 2014 and China 2020 (industry-nominated trainers produced welfare cost); Masson 2018b (real-world use is by lay guardians without professional advice).
"Controllability or predictability makes aversive use safe"	Limbachia et al. 2021 (attenuation, not elimination); Wood et al. 2014; Cain 2019 (active avoidance is goal-directed under threat); Maier & Watkins 2005 (controllability modulates but does not eliminate); Sears 2026 (safety signals defined by aversive contingency); L. Pessoa, personal communication, April 10, 2026; D. C. Knight, personal communication, April 17, 2026 (both senior authors disclaim the proponent reading).
"Low-level stim is benign" / "It is just a tingle on a low setting"	Dubin & Patapoutian 2010 (nociceptors fire below injury threshold); Raja 2020 (IASP definition); Affolter & Moore 1994 (canine epidermis 3-5 cell layers); Lines 2013 (87-fold range, 81x within-collar ratio, 2/13 manufacturing faults, no point-of-sale disclosure); Cooper 2014 (low-level industry-best-practice protocol still produced welfare cost); Lindsay textbook is not peer-reviewed welfare research.
"My dog looks happy in training"	Schilder & van der Borg 2004 (conditioned emotional response persists); Deldalle & Gaunet 2014 (direct observational coding of stress and reduced guardian-directed gaze); Casey 2021 (persistent affective state); Cain 2019 (calm-looking dog is in anxiety state mediated by avoidance, not absence of threat).
"The welfare effect is short-term" / "The dog gets over it"	Casey et al. 2021 (cognitive bias measures persistent affective state); Vieira de Castro 2020 (post-training cortisol elevation); Schilder & van der Borg 2004 (persistence in non-training contexts).
"Balanced training is moderate" / "Mixing rewards with punishment is fine"	Blackwell et al. 2008 (highest aggression scores in mixed methods); Vieira de Castro 2020 (mixed-methods schools showed welfare cost too).
"Aversive training builds respect or stronger relationship"	Vieira de Castro et al. 2019 (Strange Situation Procedure showed weaker attachment under aversive training).
"Punishment teaches the dog faster"	Rooney & Cowan 2011 (lower learning on novel tasks); Hiby et al. 2004 (reward correlated with obedience).
"It only applies to small dogs" / "It only applies to large dogs"	Arhant et al. 2010 (size-stratified analysis confirms pattern across both).
"I only use e-collars on dogs that need them"	Blackwell et al. 2012 (guardian characteristics predict use, not dog characteristics).
"It worked for my client" / "Hundreds of success stories"	Blackwell et al. 2012 (e-collar users reported lower training success); the convergent welfare evidence shows visible suppression and welfare cost can coexist.
"Confrontational handling works for aggression"	Herron et al. 2009 (clinical data: 26 to 43% aggressive responses); Casey et al. 2014 (population-level corroboration).
"Electronic containment improves safety"	Starinsky, Lord, & Herron 2017 (electronic fence 44% escape vs physical fence 23%; no clear protective effect).
"Ordinary collar use is mechanically harmless"	Pauli et al. 2006 (IOP elevation under pull); Carter et al. 2020 (no collar tested produces injury-mitigating pressure); Hunter et al. 2019 (everyday-walking pressure substantial); Rozanski 2022 (tracheal collapse clinical concern).

Argument or Objection	Studies That Counter It
"Choke chains never cause serious harm"	Grohmann et al. 2013 (peer-reviewed case report: fatal cerebral ischemia from choke-chain hanging).
"Safety reinforcement makes it positive, not aversive"	Sears et al. 2026 (safety signals acquire value only from inverse relationship with the aversive contingency; overtrained avoidance recruits OCD circuit); Cain 2019 (active avoidance is goal-directed under threat).
"Johnson & Wynne 2024 proves e-collars are necessary for predatory chasing"	Bastos et al. 2025 (peer-reviewed methodological critique); Bangura 2025 SSRN methodological critique; Johnson & Wynne 2025 response did not resolve the substantive concerns. The study establishes narrow efficacy under specific protocol conditions, not necessity, welfare neutrality, or broad real-world superiority.
"Christiansen 2001 supports e-collars for predation"	Christiansen 2001 itself: welfare measures were methodologically thin (guardian report and temperament tests, no physiological or cognitive bias measures). Authors recommend use only for livestock-protection. Masson 2018b (real-world use is unrelated to predation).
"Schalke 2007 supports controllable e-collar use"	Schalke 2007 itself: all groups experienced welfare cost; authors' overall conclusion supports the welfare case.
"Tortora 1983 supports e-collar use for aggression"	Tortora 1983 itself: complex multi-stage protocol with extensive +R, not simple aversive. Author's own Experiment 3 undermines the proponent reading. 1983 design predates contemporary welfare-science methodology.
"Lindsay's textbook says low-level stim is just a tickle"	Not peer-reviewed welfare research. Contradicted by nociception science (Dubin & Patapoutian 2010; Raja 2020; Lines 2013; LeDoux 2014 framework; Carter 2020 mechanical findings).
"TENS units and e-collars work the same way"	TENS operates below the nociceptive threshold (gate-control mechanism). E-collar peak energies measured by Lines 2013 (3.3 to 287 mJ at 50 kohm canine neck impedance) are substantially higher than therapeutic TENS, and the relationship between user setting and delivered stimulus is not standardized.
"The dog will recover after the session ends" / "It's just temporary stress"	Vyas et al. 2002 (chronic stress remodels hippocampus and amygdala in opposing directions); Rosenkranz et al. 2010 (chronic stress produces lasting amygdala hyperexcitability); McEwen 2012 (allostatic load framework: cumulative effects do not return to baseline); Arnsten 2009 (cumulative prefrontal cortex effects). The single-session framing measures the wrong exposure window.
"Pack leader / alpha / dominance theory justifies the correction"	Schenkel 1947 (origin of framework, captive-wolf observations only); Mech 1999 (wild wolf packs are family groups, not alpha-status struggles, in peer-reviewed retraction by the framework's most prominent popularizer); Mech 2008 (public retraction restating the 1999 finding); Herron et al. 2009 (confrontational handling produces aggression at clinically significant rates, regardless of theoretical justification).
"Show me one source that summarizes all this"	Ziv 2017 (systematic review of 17 peer-reviewed comparative studies; concludes positive punishment is not more effective than positive reinforcement and that aversive methods can jeopardize physical and mental health). The convergent welfare evidence is summarized in this single peer-reviewed review.

> *Use this table in real time during exchanges. The argument the opponent makes is in the left column; the studies that counter it are in the right column. Cross-reference back to the corresponding profile in the playbook body for the full citation, deployment language, and honest acknowledgment of limits.*

About the Author

WILL BANGURA, M.S., CAB-ICB, CBCC-KA, CPDT-KA, FDM, FFCP

Will Bangura is a Certified and Accredited Canine Behaviorist with more than 35 years of experience specializing in severe aggression, fear, anxiety, reactivity, phobias, and compulsive disorders in dogs. His work is grounded in behavioral psychology, applied behavior analysis, learning theory, affective neuroscience, and evidence-based animal behavior science.

This Studies Playbook is the source-organized companion to *The Scientific Case Against Aversive Dog Training Equipment and Methods* (Bangura, April 2026). The policy paper organizes the evidence by argument; this playbook organizes it by source. Both documents are intended for working practitioners, educators, and policy stakeholders engaging with the peer-reviewed literature on canine welfare and training methodology.