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Conseil canadien de protection des animaux



CCAC guidelines: Dogs

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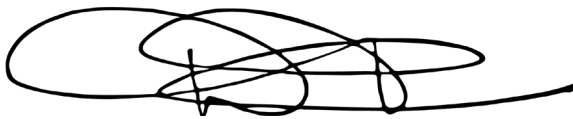
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CONTENTS

PREFACE.....	1
SUMMARY OF THE GUIDELINES LISTED IN THIS DOCUMENT.....	2
1. INTRODUCTION	7
1.1 The Role of Dogs in Society.....	8
1.2 Dog Welfare.....	8
1.2.1 Cognitive Abilities of Dogs.....	9
1.2.2 Affective Experiences of Dogs.....	9
1.2.3 Species-Typical Behaviours	10
1.3 Behavioural and Social Development	10
1.4 Senses.....	11
1.4.1 Olfaction.....	11
1.4.2 Hearing.....	12
1.4.3 Sight.....	12
1.4.4 Touch.....	12
1.5 Sources of Variation	12
2. FACILITIES.....	14
2.1 Sound Control.....	15
2.2 Primary Enclosures.....	16
2.2.1 Spatial Requirements	17
2.2.2 Enclosure Design.....	19
2.3 Exercise and Play Areas.....	20
2.4 Quarantine Areas.....	21
2.5 Day-Use Areas for Shelter or Client-Owned Dogs.....	21
3. FACILITY MANAGEMENT AND PERSONNEL.....	22
3.1 Water.....	22
3.2 Light.....	22
3.3 Temperature and Relative Humidity	23
3.3.1 Temperature	23
3.3.2 Relative Humidity.....	23
3.4 Sound and Vibration	23
3.5 Odour	24
3.6 Air Quality.....	24
3.7 Personnel.....	24

4. PROCUREMENT	26
4.1 Source	26
4.1.1 Purpose-Bred Dogs	26
4.1.2 Non-Purpose-Bred Dogs.....	27
4.1.3 Client-Owned Dogs	28
4.2 Transport of Dogs	28
4.2.1 Pre-Shipment Procedures.....	28
4.2.2 Transportation	29
4.3 Receiving Animals	30
4.4 Quarantine and Acclimation After Receipt of Animals.....	30
4.4.1 Quarantine	31
4.4.2 Acclimation	31
5. BREEDING	32
5.1 Breeding Age and Frequency	32
5.2 Pregnancy.....	33
5.3 Parturition.....	33
5.4 Care of Puppies	34
5.5 Weaning Age.....	34
5.6 Development and Socialization of Puppies	35
5.7 Record Keeping in Relation to Breeding.....	35
6. HUSBANDRY	37
6.1 Identification.....	37
6.2 Animal Observation	37
6.3 Housing Management	38
6.3.1 Barking.....	38
6.3.2 Social Interaction.....	38
6.3.3 Establishing Compatible Pairs or Groups or Introducing a New Dog.....	40
6.3.4 Feeding Behaviour.....	40
6.3.5 Space Requirements	40
6.3.6 Use of Objects	41
6.4 Nutrition, Feeding, and Water.....	41
6.4.1 Nutrition	41
6.4.2 Feeding.....	42
6.4.3 Water	43
6.5 Physical Activity.....	43
6.6 Environmental Enrichment.....	44
6.6.1 Social Enrichment	45
6.6.2 Food-Based Enrichment.....	46
6.6.3 Physical Enrichment	46
6.6.4 Cognitive Enrichment	47
6.6.5 Sensory Enrichment	47

6.7	Human Contact and Handling.....	48
6.8	Cleaning and Sanitation.....	49
6.9	Record Keeping.....	50
7.	TRAINING AND RESTRAINT	52
7.1	Training.....	52
7.1.1	Training Program	53
7.1.2	Factors That Affect Training Success	55
7.1.3	Training Applications.....	57
7.2	Use of Anxiolytic Medication for Restraint.....	58
7.3	Physical Restraint.....	58
8.	WELFARE ASSESSMENT	60
8.1	Welfare Indicators	61
8.1.1	Animal-Based Measures.....	61
8.1.2	Resource-Based Measures	65
8.1.3	Management-Based Measures	65
9.	HEALTH AND DISEASE CONTROL.....	66
9.1	Disease Prevention	66
9.1.1	Immunizations.....	68
9.2	Health Monitoring and Disease Detection.....	68
9.2.1	Routine Health Monitoring.....	68
9.2.2	Physical Exams.....	69
9.3	Disease Management in the Event of an Outbreak	69
10.	SCIENTIFIC PROCEDURES.....	70
10.1	Administration of Substances and Sample Collection.....	71
10.1.1	Administration	71
10.1.2	Sample Collection	72
10.2	Anesthesia and Analgesia	73
10.2.1	Anesthesia.....	73
10.2.2	Analgesia.....	75
10.3	Surgery	76
10.4	Post-Procedural Monitoring and Care.....	78
11.	HUMANE KILLING.....	79
11.1	Methods of Humane Killing.....	80
11.2	Disposal of Dead Animals	80
12.	OUTCOMES FOR ANIMALS AT THE END OF SCIENTIFIC ACTIVITIES.....	81
12.1	Transfer of Dogs Between Animal Use Protocols or Facilities	81
12.2	Rehoming.....	82

13. HUMAN SAFETY.....84

REFERENCES.....86

APPENDIX 1
DOG HOUSING AND MANAGEMENT SYSTEM ASSESSMENT TOOL 103



Dogs

PREFACE

The Canadian Council on Animal Care (CCAC) is the national peer-review organization responsible for setting, maintaining, and overseeing the implementation of standards for ethical animal care and use in science throughout Canada. CCAC standards are based on professional expertise and current interpretation of scientific evidence.

The *CCAC guidelines: Dogs* is part of a series of animal-specific guidelines documents that build on the general guidelines documents by providing additional guidance for the ethical care and use of particular species or groups of animals in science. Animal-specific guidelines documents provide detailed information for protocol authors, animal care committees, facility managers, veterinarians, technicians, and animal care personnel to help facilitate improvement in both the care given to animals and the manner in which scientific activities are carried out.

This guidelines document details the standards that are expected to be met by holders of the CCAC Certificate of GAP – Good Animal Practice®. For scientific activities conducted within Canada or outside of Canada, protocol authors based at CCAC-certified institutions are subject to these standards. Protocol authors are also subject to any relevant legislation and regulations in the jurisdiction where the scientific activity is conducted.

SUMMARY OF THE GUIDELINES LISTED IN THIS DOCUMENT

The following list of guideline statements serves as an executive summary covering the most important aspects of the care and use of dogs. These guideline statements are included throughout this document alongside details and references that provide support and context for their implementation. Throughout this document, the term 'should' is used to indicate an obligation, for which any exceptions must be justified to, and approved by, an animal care committee. The term 'must' is used for mandatory requirements.

2. FACILITIES

Guideline 1

Facility designs for housing dogs should provide spaces that promote good welfare, which includes physical and emotional health. These spaces should allow dogs to express behaviours that fulfill their behavioural needs and provide positive affect, positive social interactions, and some degree of choice and control over how they interact with other dogs, people, and features of the environment.

p.14

3. FACILITY MANAGEMENT AND PERSONNEL

Guideline 2

Facility management practices must ensure that the macroenvironment (room) and microenvironment (enclosures) maintain good welfare of both the animals and personnel.

p.22

4. PROCUREMENT

Guideline 3

Purpose-bred dogs should be sourced.

Section 4.1.1 Purpose-Bred Dogs, p.26

Guideline 4

Institutions must only procure non-purpose-bred dogs from owners or organizations with which they have a well-defined arrangement that has been approved by the animal care committee.

Section 4.1.2 Non-Purpose-Bred Dogs, p.27

5. BREEDING

Guideline 5

Breeding must be managed according to approved animal use protocols, anticipated needs, and the Three Rs principles.

p.32

Guideline 6

Facilities raising puppies must develop a systematic socialization program aimed at the dogs' current and long-term physiological and behavioural development.

Section 5.6 Development and Socialization of Puppies, p.35

6. HUSBANDRY

Guideline 7

The nutrition and feeding of dogs should follow current science-based standards.

Section 6.4 Nutrition, Feeding, and Water, p.41

Guideline 8

In addition to routine daily interactions, each dog must receive varied, positive human contact.

Section 6.7 Human Contact and Handling, p.48

7. TRAINING AND RESTRAINT

Guideline 9

Training methods that are stress-, fear-, and force-free must be used.

Section 7.1.1 Training Program, p.53

Guideline 10

A flexible training program should be developed for each dog, tailored to individual differences in learning.

Section 7.1.2.3 Individualized Learning, p.56

Guideline 11

Personnel conducting training must be competent, with demonstrated expertise in the handling and training of dogs using positive methods, or be under the supervision of someone with such competence.

Section 7.1.2.5 Qualities of the Trainer, p.57

Guideline 12

Dogs should be trained to cooperate during procedures to minimize the need to apply physical restraint.

Section 7.3 Physical Restraint, p.58

Guideline 13

Restraint techniques must be safe for the dog and personnel while minimizing negative welfare impacts.

Section 7.3 Physical Restraint, p.58

Guideline 14

Restraint techniques should be introduced gradually through systematic desensitization and positive reinforcement training.

Section 7.3 Physical Restraint, p.59

8. WELFARE ASSESSMENT

Guideline 15

All dogs used in scientific activities must undergo welfare assessments.

p.60

9. HEALTH AND DISEASE CONTROL

Guideline 16

All dogs should be included in an animal health program.

p.66

Guideline 17

Strategic measures for disease prevention should include a program for disease control and a system of regular monitoring and reporting for health assessment purposes.

Section 9.1 Disease Prevention, p.66

Guideline 18

Standard operating procedures must be developed for assessing animal health.

Section 9.2.1 Routine Health Monitoring, p.68

Guideline 19

A management plan must be in place to deal with unanticipated disease outbreaks.

Section 9.3 Disease Management in the Event of an Outbreak, p.69

10. SCIENTIFIC PROCEDURES

Guideline 20

The procedure with the least negative welfare impact that is suited to the goals of the scientific activity, based on the body of evidence and available expertise, must be used.

p.70

Guideline 21

Scientific endpoints, humane intervention points, and monitoring regimes must be described in an animal use protocol and approved by an animal care committee before any animal-based scientific activity commences. This information should be easily accessible to everyone working with the animals.

p.71

Guideline 22

When anesthesia is necessary, an anesthetic plan must be developed in advance and address the following stages: pre-anesthesia, induction, maintenance, and recovery. Monitoring throughout all stages must be part of the anesthetic plan.

Section 10.2.1 Anesthesia, p.73

Guideline 23

Analgesia should be used for any procedure that would be expected to be painful.

Section 10.2.2 Analgesia, p.75

Guideline 24

All members of the surgical team must be competent, with demonstrated expertise in their assigned tasks; be informed of the details of the surgery plan in advance; and rigorously adhere to the principle of asepsis to prevent infections.

Section 10.3 Surgery, p.76

Guideline 25

All surgical procedures must be well planned in advance, taking into account the individual physical characteristics of the dog involved, and include a peri-operative monitoring plan.

Section 10.3 Surgery, p.77

Guideline 26

Post-procedural monitoring and care must be planned based on the welfare impacts, including the procedure's invasiveness, risk of deterioration in the dog's welfare, and the dog's individual needs, with provisions for unexpected complications.

Section 10.4 Post-Procedural Monitoring and Care, p.78

11. HUMANE KILLING

Guideline 27

The humane killing of dogs must be carried out only by competent personnel using the method best suited to the particular animal and the objectives of the scientific activity.

p.79

Guideline 28

Sedation should be used prior to humane killing to reduce stress, keep the dog comfortable, and reduce the need for handling and restraint.

p.79

12. OUTCOMES FOR ANIMALS AT THE END OF SCIENTIFIC ACTIVITIES

Guideline 29

Whenever possible, institutions should rehome dogs used in scientific activities with individuals who have the knowledge and ability to provide care that meets those animals' needs.

Section 12.2 Rehoming, p.82

1 INTRODUCTION

Throughout this document, the term ‘should’ is used to indicate an obligation, for which any exceptions must be justified to, and approved by, an animal care committee. The term ‘must’ is used for mandatory requirements.

This guidelines document applies to all scientific activities involving the use of dogs, in which the protocol author is affiliated with a CCAC-certified institution, regardless of whether the work is conducted within an institution or off-site. The dogs used in these activities may reside outside of the facility, be brought into the facility for a short term, or be housed in the facility for a longer period. Even within an institution, the manner in which dogs are housed will vary depending on the type of activity they will be used in and potential disease risks to other animals in the facility. Examples of scientific activities using dogs that are covered by this guidelines document include scientific research using purpose-bred dogs housed in research facilities, research and teaching using dogs residing in shelters, housing of dogs in colonies for teaching purposes, use of dogs in working roles as part of an animal use protocol (e.g., for wildlife conservation), and research or teaching activities using client-owned dogs (e.g., pets). In the case of client-owned dogs undergoing clinical trials in a veterinary clinic or elsewhere, this guidelines document covers the scientific activity if the protocol author is affiliated with a CCAC-certified institution.

As with all scientific activities involving animals, the scientific or pedagogical merit of any animal use protocol involving dogs must be established, and the [CCAC Ethics Principles for Animal Use in Science](#) (CCAC, 2026) as well as the Three Rs (replacement, reduction, and refinement) (Russell and Burch, 1959) must guide the design of the scientific activity and the care of the animals. Evaluating quality, reproducibility, and translatability throughout the design, conduct, and reporting of scientific activities is key to realizing the intended value of any animal use.

Replacement is the first focus in planning animal-based activities. As with other species used in scientific activities, there must be justification that dogs are required. Thought must also be given to reduction, to determine the smallest number of animals consistent with the provision of valid information and statistical power, while minimizing the welfare impact for each animal.

The present guidelines focus primarily on refinement, both in terms of the care of dogs in a facility and the procedures carried out on dogs as part of an animal use protocol that requires approval from an animal care committee. Animals living in an environment where facilities and practices are oriented toward promoting good animal welfare are more likely to exhibit normal behaviours and physiology (Poole, 1997).

This introduction outlines the welfare basis for guidelines on various aspects of the care and use of dogs in scientific activities throughout this document.

1.1 THE ROLE OF DOGS IN SOCIETY

The long-term relationship between domestic dogs and people has shaped dogs' communicative, social, cooperative, and attachment behaviours (Miklósi et al., 2004). Dogs have co-evolved with humans for thousands of years (Lindblad-Toh et al., 2005; Bergström et al., 2020) and currently play an important role in Canadian society. As companion animals, dogs have garnered increasing recognition and acceptance as friends and members of the family (Carr and Cohen, 2009; Eckstein, 2000; Franklin, 2006; Turner, 2005; Walsh, 2009; Greenebaum, 2004; Sharada, 2013).

While many dogs are cared for by people, approximately 80% of the world's dogs are free-ranging and live in close proximity to areas inhabited by people. Free-ranging dogs are generally scavengers who consume small meals of variable composition (Marshall-Pescini et al., 2017). They differ from wolves, who hunt prey animals and feed on a less predictable basis. These differences appear to contribute to differences in cooperation, capacity for imitative learning, frequency and intensity of aggressive encounters, and behaviours following aggressive encounters (Marshall-Pescini et al., 2017). For further background information on free-ranging dogs, see Daniels and Bekoff (1989), Campos et al. (2007), Spotte (2012), Pilot et al. (2015), and Majumder et al. (2014).

The use of dogs and other companion animals in scientific activities is unique in terms of public concern and these animals' needs for human interaction. There is also growing public interest that all species are handled in a low-stress manner.

For companion animals such as dogs, the Three Rs (Russell and Burch, 1959) may be insufficient in capturing concerns related to their role in society. The treatment of dogs and other considerations reflect a relational ethic that accords special consideration to certain species based on the relationship humans typically have with those animals (Schuppli et al., 2004). It is important to be aware of the emotional experiences of personnel working with dogs in science (Schuppli, 2011). However, because of the relationship and history of humans and dogs, people are likely better able to recognize different affective states in dogs and respond to these than they are for other species. Additionally, there are opportunities for refinement through the provision of training, social companionship with people, and rehoming at the end of scientific activities.

1.2 DOG WELFARE

Animal welfare is “a concept used to characterize the physical and mental state of an individual animal and how this animal is experiencing the conditions in which it lives” (CCAC, 2021). The animal welfare assessment guidelines document focuses on affective states (Duncan, 2006; Brydges and Braithwaite, 2008; Dawkins, 2008; Mendl et al., 2009), with the aim of minimizing exposure to environments and stimuli that contribute to negative affective states (e.g., pain, fear, and frustration) while providing the opportunity for behaviour associated with positive affective states. For more details, see the [CCAC guidelines: Animal welfare assessment](#) (CCAC, 2021).

Addressing dog welfare is fundamental to all aspects of this guidelines document. The following subsection on cognitive abilities, affective experiences, and species-typical behaviours provides an overview of important characteristics of dogs. Assessment of dog welfare is further discussed in Section 8, “Welfare Assessment”.

1.2.1 Cognitive Abilities of Dogs

The domestication process likely selected for social cognitive abilities in dogs, to allow for improved communication with humans (Hare et al., 2002). Social cognition in dogs is demonstrated by the following examples:

- Dogs can interpret human social cues (e.g., pointing, gazing, and use of a physical place marker), regardless of the dog's age or rearing environment (Bensky et al., 2013).
- Dogs may act differently in response to behavioural cues when the attention state of a person is impaired (e.g., obstructed vision) (Bensky et al., 2013).
- Dogs communicate desires to humans using vocalizations, body positioning, and glances, with a communication strategy that is influenced by breed, age, background, and the identity of the handler (Bensky et al., 2013).
- Dogs can learn new things through observing and interacting with other dogs (Bensky et al., 2013).
- Dogs can recognize emotions in other dogs and in humans (Albuquerque et al., 2016; Nagasawa et al., 2011; Turcsán et al., 2015) and have shown the ability to integrate visual and auditory information to distinguish positive and negative emotions (Albuquerque et al., 2016).
- There is evidence that dogs can engage in fast mapping (i.e., making a quick inference about the meaning of a new word) (Kaminski et al., 2004).

Examples of non-social cognition in dogs include the following:

- Dogs can discriminate between different visual, auditory, and olfactory stimuli in response to different reward contingencies (Bensky et al., 2013).
- Dogs can understand that objects still exist when they can no longer see them; this is object permanence, an ability that typically develops between 5-8 weeks of age (Gagnon and Doré, 1994).
- Dogs can solve problems using trial-and-error and, in some cases, may demonstrate more sophisticated cognitive skills related to problem-solving, such as insight learning and understanding the goal of a task (Bensky et al., 2013).
- Dogs appear to create shortcuts based on previous spatial knowledge and can relate the location of objects to their own location and to the location of environmental features (Bensky et al., 2013).
- Dogs have a working memory that allows them to find an object or make a choice based on information they were presented with several minutes prior (Bensky et al., 2013).

For more information on the cognitive abilities of dogs, see the special issue on canine cognition in Katz and Huber (2018) and Cooper et al. (2003).

1.2.2 Affective Experiences of Dogs

Dogs have complex emotional lives. They experience a wide variety of negative emotions, including fear, pain, boredom, loneliness, frustration, and anxiety (Cook et al., 2018; Harris and Prouvost, 2014) as well as positive emotions, including comfort, relaxation, and confidence (Flint et al., 2024). A dog's emotional state can be inferred from an assessment of their condition (e.g., the social condition) and behavioural and physical measures, such as posture, vocalization, and various other behaviours and movement patterns. However, many behaviours are non-specific indicators that could have multiple underlying causes. For

example, vocalizations are used to communicate and may indicate distress (e.g., whimpers of puppies or a high-pitched bark of an adult) or arousal and excitement (Prescott et al., 2004). Vocalizations can vary in terms of frequency, tonality, and rhythmicity, depending on the context (Pongrácz et al., 2010), and barking may become stereotypic in dogs housed in suboptimal conditions (Prescott et al., 2004). Examples of indicators of positive and negative affective states are provided in Section 8.1.1, “Animal-Based Measures”.

1.2.3 Species-Typical Behaviours

It is important that dogs are given opportunities to express species-typical behaviours associated with positive affective states. Such behaviours, termed “behavioural needs”, are internally driven. Dogs may experience negative affective states (e.g., anxiety and frustration) when they are prevented from performing these behaviours.

Social interaction with humans and other dogs, including greeting interactions between dogs, is important for their welfare (Coppinger and Coppinger, 2002). In shelter dogs, environmental enrichment in the form of human interaction has been shown to reduce stress and aggression (Willen et al., 2019).

The ability for groups of dogs to engage in affiliative interactions with other dogs is important to their welfare. Individual housing that prevents positive social interactions increases behaviours indicative of negative affective states, such as stereotypic behaviour (Mertens and Unshelm, 1996) and aggressive behaviour (Wormald et al., 2016). However, it is important to recognize that not all patterned behaviours indicate pathology or stress; for example, some dogs engage in behaviours related to food caching even when the necessary substrate is not present, and this is a normal motor sequence (Gadbois et al., 2015).

Other natural behaviours important to dog welfare include:

- signalling behaviours to communicate moods (e.g., agonistic behaviours)
- exercise (both the type and amount of movement)
- play
- chewing
- scent marking
- exploration of novel places and items
- activities that allow for problem-solving and learning opportunities

In captivity, dogs tend to urinate and defecate in an area separate from their sleeping area (Prescott et al., 2004). Adult male dogs prefer to urinate on vertical surfaces and in multiple locations.

Scent marking occurs through urination, scratching, and rubbing (Field and Jackson, 2006), and plays a role in communication. Scent marks transmit information about identity and social status (Prescott et al., 2004; Bekoff, 2001). Smelling for conspecific odours and odour searches for food are important to dogs’ welfare.

1.3 BEHAVIOURAL AND SOCIAL DEVELOPMENT

Dogs are social animals and the early months of a puppy’s life are particularly important for socialization and habituation to novel stimuli (MacArthur Clark and Pomeroy, 2010), although it is important that some form of socialization continue throughout a dog’s life (Howell et al., 2015). Socializing dogs from an early stage

provides important benefits, such as improved welfare, increased ease of handling, and increased suitability for potential rehoming at the end of the scientific activity. The importance of maternal care, socialization, and skill acquisition for puppies is described in Section 5.6, “Development and Socialization of Puppies”.

Tactile experiences among dogs and between dogs and people are important for socialization and habituation (Prescott et al., 2004). The sense of touch is one of the first senses to develop in puppies, and positive tactile contact is particularly important to the emotional state and physiological response of very young dogs (Prescott et al., 2004).

Human interactions play an important role in dog welfare in scientific settings. The personality and attitude of a person can positively or negatively impact a dog, and their interactions may contribute to hormonal changes in the dog (Payne et al., 2015). Dogs have been shown to exhibit attachment behaviour toward an individual handler (Gácsi et al., 2001), and the presence of a familiar person has been shown to provide a sense of security for dogs and positively affect their motivation to perform cognitive tests (Horn et al., 2013). Additionally, dogs that have developed a secure attachment relationship display greater persistence in performing cognitive tasks than those who have not developed that relationship (Thielke and Udell, 2019).

1.4 SENSES

Touch is one of the first senses developed in puppies (Prescott et al., 2004). Dogs typically develop olfaction by two weeks of age, hearing by four weeks of age, and vision by six weeks of age (Lord, 2013). Puppies typically begin exploring their environment around four weeks of age, when they have developed the ability to smell and hear (Lord, 2013).

The conscious experience of pain in dogs begins at least one week after birth; however, stimulation of nociceptors by invasive procedures prior to conscious pain perception can have implications for pain sensitivity later in life (Mellor, 2018).

The senses described in the sections below have important welfare implications for dogs, and, as described in a review paper by Siniscalchi et al. (2018), play an important role in communication among dogs and between dogs and people.

1.4.1 Olfaction

Dogs have a highly developed sense of smell and are able to detect some odours at concentrations that are much lower than those detectable by humans (Krestel et al., 1984; Marshall and Moulton, 1981; Walker et al., 2006). This ability is demonstrated by a study that found dogs were able to locate a mouse in a one-acre field in less than one minute (Scott and Fuller, 1965). Their strong sense of smell and capacity for olfactory learning enable working dogs to perform a wide array of tasks involving the search, detection, discrimination, and identification of odours (Gadbois and Reeve, 2014; Hall and Wynne, 2016). Olfaction is also involved in food selection and is key for tasting (Prescott et al., 2004).

Olfaction coupled with scent marking provides information on the identity and social status of other dogs (Prescott et al., 2004). There is a possibility that dogs can sense fear in other dogs through their sense of smell (Siniscalchi et al., 2016).

Dogs can identify odours from different people and from different body parts of a person, which may be a consideration when there are changes in personnel caring for or handling dogs (Prescott et al., 2004).

1.4.2 Hearing

Dogs hear in a wider frequency range than humans and are more sensitive to sound (Sales et al., 1997; Scheifele et al., 2012). They are able to detect sounds that are four times quieter than those humans can hear (Prescott et al., 2004), and their welfare may be negatively impacted by sounds that are not audible to the human ear. High noise levels, such as those occurring in kennels, can pose a risk of hearing loss in dogs (Scheifele et al., 2012).

1.4.3 Sight

Dogs can see at a distance, but their range of visual acuity is narrower than for humans; objects that are close or far away appear blurred (Prescott et al., 2004). Dogs have good night vision (Prescott et al., 2004) and colour vision. However, their colour vision spans a narrower range than that of humans, and an orange object on green grass does not stand out as much to a dog (Prescott et al., 2004) as it would to a human. This is particularly important for cognitive tasks that rely on colour discrimination.

1.4.4 Touch

Touch includes the perception of pressure, temperature, roughness or smoothness, and noxious substances. Some tactile contact (e.g., stroking) can positively impact a dog's emotional state and physiological responses (Prescott et al., 2004) and be important to their welfare. Human interaction has been found to lower plasma cortisol levels in shelter dogs (Dudley et al., 2015; Shiverdecker et al., 2013) and lessen excitement and fear-related behaviour such as panting (Shiverdecker et al., 2013), when the petting is gentle (Hennessy et al., 1998, 2020). However, some dogs find touch aversive.

The sense of touch develops very early in dogs, and early tactile experiences are important for socialization (Prescott et al., 2004). Additionally, positive tactile contact with a female during pregnancy may have a positive impact on the puppies' ability to handle stressful situations later in life (Prescott et al., 2004).

1.5 SOURCES OF VARIATION

Dogs' physical, physiological, and behavioural characteristics vary widely due to genetics, the environment, and the interaction between the two (i.e., epigenetics). Dog breeds have been genetically selected for physical and behavioural traits considered desirable by humans. Dogs with particular temperaments¹ (Cloninger, 1994) and skills² have been used in agricultural and hunting activities for centuries and selected in breeding programs (Lord et al., 2014). This selection for desirable traits has led to extensive variation in physical, physiological, and behavioural characteristics, both between and within dog breeds (Svartberg, 2007; Gadbois and Reeve, 2014). However, it is important to focus on each individual animal, rather than ascribing preferences or behavioural dispositions based on the breed or suspected breed composition (Morrill et al., 2022) and address physical and personality differences in all aspects of housing, husbandry, and the

¹ Temperament refers to those affective, psychobiological, and behavioural traits that show consistency over time and across situations and that differ between individuals.

² Skills refer to those behavioural traits that certain breeds are highly motivated and adept to perform.

conduct of scientific activities. Many of the statements in this document are general, and some practices that commonly contribute to positive welfare for dogs may not be perceived as positive by all dogs.

Dogs' anatomical and physiological characteristics have important implications for their housing, care, and use in scientific activities. For example, jumping from high platforms is detrimental to dachshunds' backs. Breeds respond to temperature differently, such as bulldogs, who can easily overheat, and huskies, who have a thick, double-layer coat that provides insulation from hot and cold temperatures. In contrast, miniature greyhounds have a thin, single-layer coat. Soft bedding is particularly important for breeds that are susceptible to pressure sores.

Size differences affect heart rate (e.g., 60-80 beats per minute in large breeds; 90-130 in small breeds) and respiratory rate (e.g., 16 breaths per minute in large breeds versus 30 in small breeds). Differences among breeds also exist in brain size and cognition (Horschler et al., 2019), learning (Azadian and Protopopova, 2024), thermal pain sensitivity (Bowden et al., 2018), immune response (Holder et al., 2015), and inherited diseases (Asher et al., 2009).

Temperament traits have been shown to be heritable (MacLean et al., 2019); however, there is evidence that assuming a dog's temperament based on their breed or suspected breed composition can be inaccurate (Morrill et al., 2022).

Variation across breeds has been found in dogs' visual communication with people (Konno et al., 2016), ease of training, interest in playing with people, and fearfulness (Asp et al., 2015), and in the onset of fear-related avoidance behaviour in puppies (Morrow et al., 2015). While little variation within a breed has been found for some behaviours (Scullion Hall et al., 2017), a recent study found that behavioural differences among Beagles may be influenced by gene-environment interaction (Turcsán et al., 2020).

The housing environment can introduce variation in dog behaviour. For example, the early rearing environment of puppies and whether they were handled impacts their social stability (Gazzano et al., 2008). Other environmental factors include stress during the neonatal period and experiences in later life.

Dogs that are purpose-bred for research exhibit less variation and greater predictability than dogs from shelters in terms of health status, mortality, behaviour, impact of confinement, impact of procedures, ability to be trained, and socialization to people or other dogs (Prescott et al., 2004).

It is also important to be aware that variation among dogs or breeds has the potential to influence people's perception of particular dogs and cause them to act in a manner that could negatively impact a dog's welfare. For example, a survey of the general public and veterinarians found that the vast majority perceived smaller breeds as being more sensitive to pain than larger breeds (Gruen et al., 2020), which may have implications for the recognition and management of pain in larger dogs.

2 FACILITIES

This section outlines the physical features to be incorporated when setting up facilities for housing dogs. For guidance on managing the facilities, see Section 3, “Facility Management and Personnel”, and for guidance on managing the housing of dogs within these facilities, see Section 6.3, “Housing Management”.

These guidelines apply to facilities for all dogs owned by institutions and to other dogs temporarily held at institutions. Institutions are responsible for ensuring that the housing and care of the dogs they own and of other dogs that enter their facilities meet the standards described in this guidelines document. In most cases, dogs will be housed within an institution, such as purpose-bred dogs that are involved in scientific activities with strict environmental requirements and dogs housed in colleges and universities for teaching purposes. If a dog owned by an institution is to be housed outside of the institution, such as for short-term fostering, the arrangement must be approved by the animal care committee, and the facilities must meet applicable institutional standard operating procedures (SOPs).

For activities involving dogs in facilities not subject to CCAC oversight (e.g., shelters), the scientific activity must be justified to the animal care committee, and any deviation from CCAC standards for facilities must be explained to the animal care committee prior to approval. Animal care committees should evaluate the risks of conducting scientific activities in settings that are not CCAC-certified and ensure measures are taken to reduce those risks and address the welfare needs of the dogs involved in the scientific activity (e.g., have a veterinarian visit the site). For dogs from the community that are held within institutions on a temporary basis, see Section 2.5, “Day-Use Areas for Shelter or Client-Owned Dogs”.

Guideline 1

Facility designs for housing dogs should provide spaces that promote good welfare, which includes physical and emotional health. These spaces should allow dogs to express behaviours that fulfill their behavioural needs and provide positive affect, positive social interactions, and some degree of choice and control over how they interact with other dogs, people, and features of the environment.

When dogs are housed in CCAC-certified institutions, the general guidance in the [CCAC guidelines: Laboratory animal facilities](#) (CCAC, 2024a) applies. Additional guidance specific to housing dogs in those facilities is presented in this section.

Where it is expected that dogs will be rehomed following scientific activities (see Section 12.2, “Rehoming”), facilities should be designed to provide opportunities to prepare dogs for that transition (e.g., provide opportunity for house training and exposure to furniture, stairs, household appliances, and outdoor access where possible).

In many facilities, dogs are housed in multiple primary enclosures (e.g., pens) within a room, while in other facilities, the room is the primary enclosure. Where dogs are free to move within a room, the room is

considered the primary enclosure, as described in Section 2.2, “Primary Enclosures”. The room layout must be designed so that there are no areas where dogs can become trapped under or between structures.

The permanent structures of dog facilities should be designed for good sanitation and hygiene practices. This design does not preclude the use of litter or soft bedding that can be removed or cleaned (see Section 2.2.2.4, “Furnishings”). Each room should be equipped with a hose station with spray nozzles, floors that slope toward drains, drain troughs, and a floor drain (Field and Jackson, 2006). The slope of the floor should be the minimum that provides good drainage. All surfaces should be sanitizable and moisture-resistant. Flooring should be non-permeable, non-toxic, and resistant to stains and chemicals.

2.1 SOUND CONTROL

Sound control should be incorporated into facility design. Sound in facilities housing dogs has been reported to be at levels that are potentially damaging to human hearing (Sales et al., 1997). This also raises welfare concerns for dogs, particularly given the wider range of frequencies over which they can hear (Sales et al., 1997; Scheifele et al., 2012). Dogs exposed to high noise levels (>100 decibels (dB)) over a prolonged period have exhibited hearing loss (Scheifele et al., 2012).

A primary source of noise in dog facilities is barking (Sales et al., 1997). Possible measures to mitigate this and other sources of noise when setting up facilities include:

- avoiding long hallways that facilitate sound travel (Prescott et al., 2004)
- using glass or transparent partitions that allow dogs to see other dogs and human activity in the room, which may result in less barking as the dogs are not startled by events occurring around them (MacArthur Clark and Pomeroy, 2010)
- using sound-absorbing materials and furnishings (Prescott et al., 2004), including sound-absorbing materials on walls and metal gates and doors (with an SOP on opening and closing them gently), rubber stoppers on doors, and rubber on the bottom of water bowls
- insulating noisy equipment that is disturbing to dogs
- using doors with quiet-closing mechanisms
- designing facilities to enable dog housing in a manner that reduces the exposure to stimuli that elicit barking
- planning human and dog traffic flow within the room to avoid disturbing other dogs who may be resting or sleeping

While potential sources of noise are a key factor when setting up dog facilities, if dogs bark excessively, the cause of the barking must be investigated and addressed in a manner that improves their psychological state, as noted in Section 6.3, “Housing Management”.

In multi-species facilities, dog housing, play, and visitation areas should be designed to minimize disturbance to other dogs that may experience distress or anxiety due to the sound of barking or the sight and smell of other dogs. This can be achieved by separating them using distance or visual barriers and sound insulation.

2.2 PRIMARY ENCLOSURES

The primary enclosure is generally the housing unit for a dog (i.e., microenvironment) within a room (i.e., macroenvironment). However, when dogs are freely housed within a room, the room is the primary enclosure. In both cases, dog housing should accommodate the dogs' diverse needs and be versatile to adapt to changes in their needs (e.g., older dogs may need ramps, lower furnishings, and softer bedding). For dogs from the community that are to be housed during the day for short-term scientific or teaching purposes, see Section 2.5, "Day-Use Areas for Shelter or Client-Owned Dogs".

Primary enclosures for dogs should be designed for group housing or pair housing at a minimum. As noted in Section 6.3, "Housing Management", dogs can only be singly housed where there is an animal-care-committee-approved scientific or animal welfare justification. If dogs are singly housed, there should be visual, olfactory, and possibly tactile interaction with humans or conspecifics in a manner that enhances their welfare. Limiting any of these forms of interaction is only justifiable based on concerns for animal or human health and welfare.

Important elements that should be incorporated into a dog's primary enclosure include:

- space, with the inclusion of a play area, to allow dogs to engage in behaviours that meet their physical, physiological, and psychological needs, and the opportunity to have separate areas for eating, drinking, elimination, resting, breeding (where indicated), and play (see Section 2.2.1, "Spatial Requirements")
- wide visibility outside of the enclosure in a manner that does not expose the dogs to stimuli that elicit barking (Prescott et al., 2004)
- choice of resting places or platforms
- easy and safe access for dogs moving to and from the enclosure
- good visibility of the dogs by personnel
- the ability for personnel to deliver food treats and for dogs to interact with humans if they choose

Purpose-built facilities with modern enclosure design (i.e., increased space and visibility, a choice of locations, exit points, ledges, the provision of climbing frames, and toys), along with environmental enrichment (see Section 6.6, "Environmental Enrichment"), indoor and outdoor play areas, and regular training (Scullion Hall et al., 2017) contribute to positive welfare and should be replicated. Dogs in smaller enclosures that are inadequately furnished or inadequately equipped with resources exhibit more behavioural indicators of negative welfare (e.g., pacing, stereotypies, and postures and interaction with the environment indicative of vigilance and agitation) (Scullion Hall et al., 2017).

Dogs should be housed in enclosures that have an indoor component with an environmentally controlled, dry, draft-free area for resting and sleeping (RSPCA, 2011) and an outdoor component that provides opportunities for exercise and stimulation (Spangenberg et al., 2006). Where outdoor access is not possible, dogs should be provided with some access to natural daylight through windows and an indoor area where small groups of dogs can exercise together (MacArthur Clark and Pomeroy, 2010).

Dogs benefit from the ability to exercise some degree of choice and control over aspects such as noise, lighting, humidity, drafts, temperature levels, social interactions, elimination locations, resting locations, and activities such as feeding. Dogs seek out environments that provide them with positive experiences and avoid environments associated with negative experiences. Enclosures should be designed to provide dogs with choice and control to allow them to access those features of the environment that suit their preferences,

and they should accommodate variation in preferences between individual dogs and over time. Housing should be designed to allow dogs to control the amount of contact they have with other dogs or personnel through the inclusion of refuge areas (RSPCA, 2011).

Dog housing must allow for the inclusion of effective environmental enrichment (see Section 6.6, “Environmental Enrichment”) and support activities such as regular training and contact with personnel (see Sections 7.1, “Training”, and 6.7, “Human Contact and Handling”), which have been shown to lead to better welfare for the dogs, based on behavioural indicators of positive welfare (Scullion Hall et al., 2017).

The ability to partition or vary dog housing facilitates the mitigation of welfare concerns that arise in existing housing and the requirements of scientific activities. Enclosures should be flexible in size, with openings that can allow or restrict the movement of dogs between enclosures (MacArthur Clark and Pomeroy, 2010).

Multi-tiered enclosures should not be used as they can have negative welfare impacts on dogs and can impede observation and low-stress handling. The use of multi-tiered enclosures requires justification to the animal care committee that they are necessary and no alternatives exist to meet the scientific objectives, post-operative recovery, or veterinary treatment. If multi-tier enclosures are approved for use by the animal care committee, they should be used for the shortest time possible. In addition, multi-tiered enclosures should only be used for small dogs because of the risk of injury to the dogs when they are moved in and out of enclosures above floor level.

Where multi-tiered enclosures are approved for use, mitigation measures must be taken to minimize their negative effects and ensure good welfare is maintained, as determined through welfare assessments (see Section 8, “Welfare Assessment”). The top enclosure must be at a height that enables personnel to safely access the dog and prevent the dog from jumping out when the door is opened, unless the dog is trained to do so safely. If dogs are to enter and exit enclosures independently, positive reinforcement training should be applied to acclimate dogs to jumping into and out of the enclosure or using ramps or steps, as needed. When dogs are to be lifted out of enclosures, they should be trained to make it a positive experience (see Section 7.1, “Training”).

Where the floor space and height of the enclosure do not allow dogs to perform behaviours important for good welfare, the dogs should be given access to additional facilities and opportunities to compensate for limitations that impact their welfare (e.g., provisions for exercise, socializing, and play). Multi-tiered enclosures must have space for elimination; however, dogs should also be allowed access to larger areas for elimination. Grid flooring must not be used between multi-tiered enclosures to prevent items from falling into the lower enclosure. Materials that minimize sound should be used within enclosure systems to reduce disturbance to the dogs.

2.2.1 Spatial Requirements

The primary enclosure should be of a size that allows the performance of a range of normal behaviours (e.g., standing, lying down, stretching, extending upward on hind legs, walking, jumping, and playing) and positive social interactions between dogs and with people. The dimensions should be able to accommodate furnishings that facilitate behaviours that dogs are motivated to perform, and maximize the use of the available space for the dogs. When housing a mother and her puppies, the mother should have a space available that allows her to isolate herself from her puppies (see Section 5, “Breeding”). While providing separate exercise or play areas has value, dogs spend the majority of their day in the primary enclosure, and emphasis should be on ensuring this space promotes positive welfare.

There should be space for dogs to have separate areas for eating, drinking, elimination, resting, breeding (where indicated), and play (Döring et al., 2016; Wagner et al., 2014). The inability for dogs to keep these areas separated may lead to anxiety (Overall and Dyer, 2005). Dogs show a desire to defecate in areas away from their resting areas and will exclusively use outdoor runs for defecation if available (Döring et al., 2016). Furthermore, allowing dogs to urinate and defecate away from their sleeping and active areas can help to prepare dogs for house training, which is particularly advantageous for dogs that will be rehomed (see Section 12.2, “Rehoming”). Each dog’s needs must be met, regardless of the length of time they are held.

Appendix 1, “Dog Housing and Management System Assessment Tool”, provides an assessment tool to assist with evaluating behaviours and elements that are key to determining the enclosure size and design. This tool is intended to assist institutions in 1) assessing whether their facilities and management practices for holding dogs meet the basic requirements, as described in this guidelines document; and 2) identifying areas for further improvement.

The tool contains elements for assessing housing, divided into Section A, “Physical Aspects of Housing Dogs”, and Section B, “Management Aspects of Housing Dogs”. Both sections must be assessed to address the welfare of the dogs being housed. Each section starts with the elements that must be met. These are followed by elements that outline conditions that should be met to ensure good welfare for the dogs, including those that promote continual improvement in dog welfare.

When using this assessment tool, the complete system of physical and management aspects should be assessed, including an evaluation of the relative amount of time that the dogs experience the various elements being assessed. When assessing the elements of a housing system, each element should be evaluated to determine if the dog is using it for the intended purpose, rather than merely documenting that the elements have been provided. For example, a shelf may be present, but it may not be of an appropriate height for the dog to access. Behavioural observations of space use should be conducted, and video recordings may also provide useful data.

The assessment should be a team approach involving the animal care committee, veterinarian, trainer, facility manager, protocol authors and their teams, and animal care personnel. These individuals should have knowledge of the unique characteristics and behaviour of the dogs being assessed (Lambeth et al., 2013).

This assessment tool is generalized and should be adapted to any additional needs of the specific dogs being held, such as those associated with their developmental stage. For example, females need to be able to retreat from puppies, and puppies need areas where they can play as a group and develop species-specific social behaviour.

It is recognized that some dogs have their needs met within a large, complex, primary enclosure, while other housing systems involve multiple areas that include a primary enclosure, one or more play and exercise areas, and activities such as dog walking. When dogs are unable to perform their full range of behaviours within their primary enclosure, alternative approaches should be used to provide opportunities for dogs to perform those behaviours. For the housing management aspects, systematic and routine behavioural assessments should be used (see Section 8, “Welfare Assessment”).

As an example of dog housing dimensions in legislation, the European Union has legislated the minimum enclosure size for group housing as 2.25 m² per dog (for dogs 10-20 kg) and the minimum enclosure size for single housing as 4 m² (Scullion Hall et al., 2017). These enclosures are unlikely to allow the physical and behavioural needs of these dogs (such as walking and play) to be fully met, and therefore, larger enclosures should be used. For these and smaller enclosures, additional measures should be taken to address the dog’s welfare.

2.2.2 Enclosure Design

2.2.2.1 Floors

Dogs should be housed on a solid floor (CVMA, 2018; RSPCA, 2011; MacArthur Clark and Pomeroy, 2010) that supports the dog without sagging. Solid floors must be used for periparturient females and puppies (MacArthur Clark and Pomeroy, 2010).

The flooring of the primary enclosure should also provide good traction for the dogs, be resistant to damage, and be constructed of impervious materials that are easy to clean and sanitize (CVMA, 2018; MacArthur Clark and Pomeroy, 2010; RSPCA, 2011). Mixed flooring textures allow dogs to select their preferred surface for different activities (e.g., rest, play, and elimination) (CVMA, 2018). When concrete is used for flooring, dogs should be given the option of soft bedding or a raised resting platform.

Grid or slatted flooring can result in physical discomfort and foot injuries, as the dog's weight is supported by a small area of the foot pad (MacArthur Clark and Pomeroy, 2010). There is some suggestion that grid flooring is preferable to solid concrete flooring for the welfare of dogs in some facilities (Stella et al., 2018); however, the use of grid or slatted flooring must be justified to and approved by the animal care committee. Where grid or slatted flooring is justified, there must be at least one solid resting area over part of the floor (RSPCA, 2011; MacArthur Clark and Pomeroy, 2010) that is large enough to allow the dog to lie down fully and rest. To prevent interdigital cysts and foot pad lesions, the size and shape of any grid or slatted flooring should be based on the dog's size (Field and Jackson, 2006).

Floors should be sloped toward drains at a pitch that allows good drainage, to prevent foot problems and prevent dogs from having to walk through or rest on soiled areas. Floor drains must be equipped with covers to prevent injury (CVMA, 2018). Heated floors can help keep the environment dry, but their maintenance can be challenging.

Where there is an outdoor component of the dogs' housing, natural flooring (e.g., grass or small, rounded pebbles) can be used. Outdoor surfaces that are abrasive, sharp, or slippery must be avoided.

2.2.2.2 Walls

The walls of enclosures and runs must be designed to prevent dogs from climbing or jumping from one enclosure to another. Adjustable solid or grid partitions can provide flexibility in the degree of contact between dogs (Field and Jackson, 2006) and allow for different configurations. Incompatible dogs should not be housed in adjoining enclosures, as it will cause negative welfare (e.g., anxiety, fear, and frustration) and may result in injury (e.g., teeth getting stuck in the grid, or clawing through the grid) (see Section 6.3, "Housing Management").

Wall designs should ensure that animal care personnel can observe the animals without leaning over the enclosure, which is less threatening to dogs and safer and more ergonomically beneficial for personnel. As previously noted, dogs would benefit from having visibility of the surroundings outside of their primary enclosure, depending on the situation.

2.2.2.3 Materials

Materials used in the construction of dog housing should be smooth, free of sharp edges, durable, impervious to moisture, and capable of withstanding high-pressure washing and sanitization (CVMA, 2018;

Field and Jackson, 2006). Materials used in places where dogs will have direct contact must be nontoxic (CVMA, 2018). For example, zinc alloy metals must not be used, as they are toxic to dogs (Field and Jackson, 2006). Any components, such as bolts and nuts, should be made of material that does not rust or corrode (e.g., stainless steel) (Field and Jackson, 2006).

2.2.2.4 Furnishings

Dog housing should incorporate features that are stimulating for dogs and allow them to make choices about how they interact with their environment (MacArthur Clark and Pomeroy, 2010). Dogs should be provided with a warm, dry area for sleeping and a refuge from other dogs (including their puppies) or people, such as a raised platform with an access ramp (RSPCA, 2011; MacArthur Clark and Pomeroy, 2010; CVMA, 2018). When given the option of a resting area versus the floor, dogs prefer to lie on a resting area (Döring et al., 2016). The resting area should contain soft bedding that can be washed or replaced when soiled. When housing older dogs, these features should be designed to accommodate potential mobility limitations.

2.2.2.5 Feed and Water Systems

J-feeders or bowl holders made of nontoxic materials should be installed to provide food (Field and Jackson, 2006). Bowls or an automatic watering system can be used to provide water, with assurance that fresh water is always available. Providing water in bowls may stimulate more natural drinking behaviour. Regardless of the watering system, dogs must be monitored to ensure they are obtaining enough water, particularly if the system is new to them.

2.3 EXERCISE AND PLAY AREAS

When exercise and play cannot be accommodated in the primary enclosure, additional areas for these activities should be provided. Even when there is sufficient space within their primary enclosure, access to these areas provides additional mental and physical stimulation (see Section 6.5, “Physical Activity”).

Exercise and play areas should be designated and specifically designed for this purpose. They should provide an alternative environment with increased stimulation and choice, compared to the dog’s primary enclosure (Hall et al., 2022). These areas should also allow space for interaction with personnel.

Examples of enrichment items that could be incorporated into exercise and play areas include:

- structures to facilitate exercise and learning (e.g., climbing and elevated structures, slides, tunnels (children’s playground equipment), and shallow swimming pools)
- a variety of surfaces (e.g., grass, gravel, tile, and mats, which are key for housebreaking and suitability for future rehoming)
- enrichment that allows the expression of natural behaviours that cannot be accomplished in primary enclosures (e.g., soil and sandboxes for digging)
- outdoor space with shelter from environmental elements
- novel objects

Exercise and play areas should have enough space for the dogs to run, chase, and play, with resources in place to minimize competition between dogs.

Dogs should be released in play areas in compatible groups. These areas should also provide dogs with the option to avoid social interaction, such as by providing solid barriers (some may have holes), a shelter, or a perch.

Exercise and play areas must have good drainage.

When an exercise or play area is outdoors, measures must be taken to provide dogs with the option to retreat from environmental conditions that could adversely impact their thermal comfort.

Examples of indoor and outdoor play areas are provided by the National Centre for the Replacement, Refinement and Reduction of Animals in Research (Hall et al., 2022). Further details on setting up an outdoor play area can be found in Dogs Playing for Life's *Play Yard Recommendations* (n.d.).

2.4 QUARANTINE AREAS

Facilities should have an area for dog quarantine, such as upon arrival at the facility (see Section 4.4.1, “Quarantine”) and when a contagious disease is suspected (see Section 9.1, “Disease Prevention”). The quarantine area must be designed to meet the dogs’ welfare needs by replicating their regular housing as closely as possible, while minimizing the potential spread of infectious pathogens. General information on the design of a quarantine area is provided in the [CCAC guidelines: Laboratory animal facilities](#) (CCAC, 2024a).

2.5 DAY-USE AREAS FOR SHELTER OR CLIENT-OWNED DOGS

Day-use areas intended for bringing in dogs from the community (shelter or client-owned dogs) should be safe for dogs and people, quiet, clean, and have easy access and exit. The day-use area should be designed to keep dogs separated from each other when entering or exiting the area.

Several factors, including the following, must be incorporated into plans to set up a day-use area:

- the risk of exposing other animals in the building to pathogens, parasites, etc.
- concerns about members of the public coming into the building
- the potential spread of pathogens among dogs coming into the day-use area

If enclosures are to be used to house shelter or client-owned dogs during the day, they must be designed to meet the dogs’ welfare needs. Guidance on permanent housing provided in this section also applies to such temporary housing; however, in most instances, group housing should be avoided.

FACILITY MANAGEMENT AND PERSONNEL

3

While dogs used in scientific activities can be housed in a variety of settings, there are basic requirements that must be in place to address their needs and promote positive welfare while on an animal use protocol. As noted in Section 1, “Introduction”, the housing and care of dogs owned by an institution or dogs that enter an institution’s facilities on a temporary basis must meet the standards described in this guidelines document. For activities involving animals in facilities not subject to CCAC oversight, protocol authors and animal care committees should evaluate risks to the welfare of dogs used in scientific activities in those settings and ensure that measures are taken to reduce the risks and meet the welfare needs of the dogs during their use in the activity.

Guideline 2

Facility management practices must ensure that the macroenvironment (room) and microenvironment (enclosures) maintain good welfare of both the animals and personnel.

3.1 WATER

There must be assurance that a potable water source is available. Water bowls must be cleaned daily, and automatic watering systems must be checked daily and flushed in accordance with the manufacturer’s instructions (Field and Jackson, 2006).

3.2 LIGHT

Natural light is preferable in many situations; however, natural day length varies. Proper lighting is key to the dogs’ well-being and should mimic natural light conditions as much as possible. Additionally, the ability to adjust light levels throughout the day can be beneficial for both the dogs and personnel working in these facilities. Lighting should be uniformly diffused throughout the housing room, and a regular diurnal cycle should be provided, controlled, and monitored. When scientific activities call for a specific light phase, supplemental artificial light with similar wavelengths to natural light should be provided. In general, when supplementing natural light with artificial light, the light phase should be set within the range of 10-12 hours (Prescott et al., 2004; MacArthur Clark and Pomeroy, 2010). A dark phase is also key for dogs, to enable sufficient sleep. Dogs should have a minimum of eight hours of uninterrupted darkness (CVMA, 2018).

Where consistent light cycles are maintained, dusk and dawn should be simulated when switching phases to mimic natural light and to prevent startling the dogs. This can be accomplished through timed brightening and dimming lights or by sequentially turning lights in an area on and off.

3.3 TEMPERATURE AND RELATIVE HUMIDITY

Environmental conditions should be monitored continually, with an alarm system to indicate when setpoints have been exceeded. If an alarm system is not available, maximum-minimum thermometers should be installed in each room and checked daily.

3.3.1 Temperature

The optimal temperature for dogs varies with factors such as age, breed, size, and coat thickness. Behavioural indicators should be used to determine if a dog's welfare is adversely affected, with adjustments made to the temperature accordingly. For example, panting or continuous sleeping are indicators that the environment is too hot, while shivering and huddling indicate that it is too cold. As a starting point for adult dogs, the temperature range is generally 18-29°C, and the room temperature is commonly set at 20-22°C (Field and Jackson, 2006). For puppies, supplemental heat should be provided, and their environment should be maintained at 26-30°C (Prescott et al., 2004).

Water, food, and bedding should not be directly exposed to heated floors or sunlight, as this can increase the temperature of these items.

3.3.2 Relative Humidity

Relative humidity should be maintained at 30-70%. The usual set point for the room is 40-50% to provide comfort for dogs and personnel (Field and Jackson, 2006). Low relative humidity can lead to the drying of a dog's mucous membranes and skin, while high humidity can result in condensation and mould, and when coupled with high temperature, can result in heat distress for dogs (CVMA, 2018).

3.4 SOUND AND VIBRATION

As noted in Section 2.1, "Sound Control", facilities should be designed to minimize noise. The sound level in dog facilities should be kept below 85 dB (CVMA, 2018), which is the maximum exposure limit for humans for an eight-hour period (CCOHS, 2025). Given that dogs have a wider hearing range than humans and are in a facility 24 hours a day, sound should routinely be well below this level. Sound in dog facilities has been found to reach levels of 85-122 dB, which can cause annoyance, stress, and damage to hearing in humans (Turner et al., 2005) and is likely to have similar effects on dogs (Prescott et al., 2004; MacArthur Clark and Pomeroy, 2010; Coppola et al., 2006; Sales et al., 1997). Hearing loss has been measured in dogs living in kennels that are routinely exposed to 100-108 dB (Scheifele et al., 2012). Excessive noise may also negatively affect sleep quality and duration in dogs (Garvey et al., 2016).

Sound intensity and the frequency of high-intensity sound in the dogs' environment should be monitored and documented. This information should be used to investigate sources of noise, identify situations that cause elevated noise, and inform mitigation strategies. A possible strategy to reduce barking when people approach is to drop treats into the dogs' enclosures when passing by (Protopopova and Wynne, 2015; Fernandez et al., 2023; Baldan et al., 2023; Zurlinden et al., 2022; Payne and Assemi, 2017).

In terms of management practices, having well-socialized dogs, personnel in numbers that allow for regular interaction with the dogs, and limiting the number of dogs per room will help control sound levels (Prescott et al., 2004). Situations where dogs are socially isolated and have only auditory contact with other

dogs should be avoided, as this has been found to increase barking (Hetts et al., 1992). Devocalization, as outlined in CVMA (2022), and bark collars must not be used (see Section 7.1, “Training”).

3.5 ODOUR

Dogs have a strong sense of smell (as noted in Section 1.4, “Senses”), and the presence of harsh chemicals and perfumes may be noxious and should be controlled. At high concentrations, these odours can stimulate the trigeminal nerve and be aversive (Brand, 2006). Any products that are caustic to epithelia (e.g., bleach and high-level peroxides) cause damage to the olfactory and respiratory pathways.

Products that mask odours should not be used as they contain volatile compounds that may negatively affect dogs, and they may conceal problems associated with cleaning and sanitation or air quality (NRC, 2011).

3.6 AIR QUALITY

Institutions must ensure clean air is available to all animals and personnel at all times, as described in [CCAC guidelines: Laboratory animal facilities](#) (CCAC, 2024a).

3.7 PERSONNEL

Personnel must be available to ensure the following:

- enclosures are cleaned, food and water are provided, and other husbandry requirements are addressed as needed
- dogs are observed at least twice daily
- dogs receive exercise, environmental enrichment, and positive human interaction as needed (see Section 6.6, “Environmental Enrichment”)

Dogs must be observed twice daily, seven days a week, by trained personnel who can recognize the behavioural, physical, and psychological signs of positive and negative welfare of dogs, as noted in Section 8.1, “Welfare Indicators” (see Section 6.2, “Animal Observation”). Issues identified in the welfare assessment must be resolved through institutional SOPs or by consulting individuals knowledgeable about dog behaviour (i.e., an ethologist or animal behaviour professional). The veterinarian and others familiar with the individual dogs should be included in the consultation. Personnel must follow proper record-keeping and reporting procedures to ensure the facility manager, veterinary team, and protocol authors remain informed and are alerted to any changes. As noted in Section 8, “Welfare Assessment”, a team approach that involves all personnel working with or caring for dogs is key to assessing the welfare of each dog.

If animals are identified as having welfare concerns, monitoring must increase in proportion to the risk to the animal. When it is expected that increased monitoring will be required for a particular animal model or scientific activity, additional monitoring requirements must be identified in the animal use protocol so that plans are in place before the scientific activity begins. Institutions must be prepared to address any additional requirements on personnel time when dogs are identified as having welfare concerns (e.g., for additional observation or the implementation of effective mitigation strategies).

Positive contact between dogs and personnel plays a major role in preventing negative associations and promoting positive welfare (Scullion Hall et al., 2017). All people in contact with dogs, including students

who walk dogs or provide other forms of enrichment, must be specifically trained to work with dogs in scientific settings or be supervised by trained personnel, as dogs housed in scientific institutions may differ in their responses and desire for interaction compared to those in a home environment. Personnel working with dogs should have expertise in stress-, fear-, and force-free methods, such as positive reinforcement training, and their implementation (see Section 7.1, “Training”). Institutional training programs should ensure that personnel who will be working with dogs are able to recognize the behavioural indicators listed in Section 8.1, “Welfare Indicators”.

4 PROCUREMENT

For general guidelines on procurement that are applicable to all species, see the [CCAC guidelines on: procurement of animals used in science](#) (CCAC, 2007). This section provides additional guidance specific to the procurement of dogs, and replaces information on dogs in Section 4.6, “Dogs and Cats”, in the [CCAC guidelines on: procurement of animals used in science](#) (CCAC, 2007).

The type of dog to be procured must be suited to the scientific activities they will be used in and the conditions at the facility where they will be held. Facility space requirements, thermal comfort (e.g., the temperature may be too warm for some breeds, such as huskies), and other welfare issues should inform procurement decisions. It is generally easier to meet the space requirements for smaller dog breeds.

4.1 SOURCE

When alternatives to animal models are not available and dogs must be used in a scientific activity, the breed and temperament of dog that is best suited to the activity and the scientific environment must be selected. Factors that may affect this decision include the purpose of the scientific activity and the importance of genetic uniformity, external validity, and translatability, and how the dogs will be impacted by the scientific activities and environment. The type of dog to be procured must be justified in the animal use protocol.

Sources with established socialization and training programs that are tailored to the age of the dogs are preferred, to ensure dogs will be optimally prepared for their time in a scientific environment and in a home environment if rehoming is a possibility. Institutions should acquire as much information about each dog as possible, such as previous housing, husbandry, training, procedures conducted, and health and behaviour records.

4.1.1 Purpose-Bred Dogs

Purpose-bred dogs used in research are sourced from specialized breeding facilities that focus on producing animals with defined genetic, environmental, and health statuses, and particular qualities that make them suitable for specific scientific activities. The significant body of background data for the Beagle, along with their manageable size, docile and friendly nature, and ease of care and handling, makes them a commonly used animal for scientific activities (Prescott et al., 2004). However, protocol authors may require other breeds, based on the scientific activity.

Guideline 3

Purpose-bred dogs should be sourced.

The use of a purpose-bred dog with a well-defined life history and health status in scientific activities can reduce variability and help minimize the number of animals required. Purpose-bred dogs may also have more experience with laboratory housing and care practices, and therefore require less habituation than dogs

from other sources. However, purpose-bred animals are not suitable for some scientific activities because of the limited variety of breeds available (e.g., the size of the particular breeds available may preclude their use in some studies) or because the goals of the scientific activity involve dogs from other sources, such as the community or shelters. The use of dogs from other sources must be justified to and approved by the animal care committee.

4.1.2 Non-Purpose-Bred Dogs

Non-purpose-bred dogs include dogs obtained from sources other than facilities breeding specifically for use in science. This could include dogs from animal shelters, dogs that are surplus to other activities, such as racing or sled pulling, or dogs that have been donated to institutions. For non-invasive scientific activities, such as for the purposes of training animal health technicians and veterinary students, where the lives of the dogs can be improved, and they can ultimately be rehomed, the use of non-purpose-bred dogs may provide benefit to both dogs and science.

Institutions should be aware that non-purpose-bred animals may incur high costs due to the degree of conditioning required. Institutions must also be ready to answer questions from the public concerning the use of these animals, recognizing that this is an area of public concern.

Animals from shelters have unknown genotypes, behavioural experiences, and disease profiles. The pathophysiological changes that may be associated with parasitism, chronic infections, poor nutritional status, and inconsistent temperament frequently encountered constitute an uncontrolled experimental variable. This may influence the results obtained and affect repeatability and interpretation (Sheets et al., 2000). Dogs that are obtained from suppliers as surplus to other activities may have a better-defined genetic background and health status than other non-purpose-bred dogs, but they may not be well socialized.

Guideline 4

Institutions must only procure non-purpose-bred dogs from owners or organizations with which they have a well-defined arrangement that has been approved by the animal care committee.

Institutions must ensure that dogs from an animal shelter have been held by the shelter for at least the length of time mandated by relevant legislation. All animals must be thoroughly checked for identification (tattoo, microchip, collar, tag, etc.) that may have been previously missed by the shelter. Dogs must be scanned with a reader capable of reading all frequencies of microchips (see CVMA, 2014). Institutions must alert the shelter if an animal is found to have any form of identification so that follow-up efforts can be made to trace the owner and return the dog. Institutions must document the procurement of all non-purpose-bred dogs, including their source and the procedures taken to discover any identification.

Where dogs of a particular breed that is not typically bred for scientific purposes are needed for a scientific activity, they may be sourced from other breeders, provided that the dogs meet the conditions of purpose-bred animals in terms of having defined genetic, environmental, and health statuses. Before purchasing the dogs, institutions must have evidence (e.g., documented site visits) to ensure the breeder is reputable and that these criteria are met. The Canadian Veterinary Medical Association's (CVMA's) *A Code of Practice for Canadian Kennel Operations* (CVMA, 2018) can be consulted for further information.

4.1.3 Client-Owned Dogs

Client-owned dogs are not actually procured by the institution; however, they are used in teaching and are a growing model in both behavioural and biomedical research. These dogs are not owned by the institution, and owners must be informed of the purpose and duration of their dog's use in the scientific activity, the procedures that will be conducted, any possible risks to their dog's welfare, and their option to cease to participate at any time without penalty. Depending on the institution, this may require additional legal or ethics board review and oversight. Owners may be asked to provide written consent that they have been informed and consent to their dog's participation prior to any scientific activities occurring.

When client-owned dogs are to be used, the institution should have SOPs that state the procedures for owner consent, including acknowledgement of any risks to the dog, and outline criteria for the dogs (e.g., vaccinations, training methods, physical exams, and welfare checks). The separation of dogs and their owners can negatively impact the dogs' welfare and must be justified. These SOPs should be addressed in each animal use protocol and discussed with the animal care committee. Animal use protocols for client-owned dogs must have clearly defined endpoints and must identify a competent person who will determine when the endpoints are reached.

4.2 TRANSPORT OF DOGS

Transport is likely to negatively impact the welfare of dogs, especially for puppies and dogs with compromised health.

4.2.1 Pre-Shipment Procedures

Transport arrangements and the individual dogs involved must be authorized by a veterinarian or a person designated by the veterinarian who knows the dogs' welfare needs. Dogs must have a welfare assessment and be determined to be fit for transport within five days of transport (MacArthur Clark and Pomeroy, 2010; Prescott et al., 2004).

Prior to shipping, positive reinforcement training should be used to ensure dogs are habituated to the transport container (MacArthur Clark and Pomeroy, 2010; Prescott et al., 2004).

Details on container design can be found in *IATA Live Animal Regulations* and Swallow (2005). Regardless of the length of the journey, the crate must allow the dog to stand in a natural position, turn around, and lie down (MacArthur Clark and Pomeroy, 2010). Crates must be designed to ensure the dogs can be assessed from outside of the crate.

Crates should have a suitable substrate (e.g., clean cloth bedding) to provide warmth and comfort for the dogs and absorb urine and feces. Materials should be chosen to minimize the potential for the dogs to shred and ingest them.

Institutions should procure puppies from suppliers with an established socialization program, as noted in Section 4.1, "Source". Puppies must be weaned, healthy, drinking, and eating independently prior to transport. The age at which puppies are suitable for transport depends on the breed and size of the dog, their response to transport, the duration and condition of transport, and applicable regulations. Puppies of some small breeds are more susceptible to hypoglycemia, while those of larger breeds are less prone to the condition.

During the last 10% of gestation, female dogs must not be transported (CVMA, 2024; Government of Canada, 2025); however, this requirement should be extended to all female dogs in the last trimester of pregnancy (>42 days gestation) as increased stress can negatively impact parturition in many species (Nagel et al., 2019) and affect the puppies' welfare (see Section 5.2, "Pregnancy"). If a scientific activity requires female dogs in the late stages of pregnancy or puppies that are too young for transport (as described above), the dogs must be bred at the institution.

For ground transport, arrangements must be made to check on the dogs during transport. If anyone involved in the transport process thinks a dog is unable to be transported for any reason, the institution transporting the dog must be able to respond immediately, which might include returning the dog to the original facility.

The optimal timing for providing food and water prior to departure depends on factors such as time in transit, total duration of transport, environmental conditions, and the age and condition of the dog. The focus must be on the welfare of the animals, with the aim of minimizing nausea and hunger. Motion sickness is common in dogs, especially juvenile dogs (Swallow, 2005). The use of anti-emetics has been shown to significantly reduce vomiting when given 2-10 hours prior to transport (Conder et al., 2008). Anti-emetics should be part of the transportation plan unless a veterinarian determines they should not be used. Dogs should be gently exercised within 30 minutes of being placed in the transport container to encourage elimination (Prescott et al., 2004; Swallow, 2005; Koziolok et al., 2019).

4.2.2 Transportation

The entire travel experience of the dogs must be taken into account in planning to meet their needs during transport and upon arrival at the institution. Both travel time and the quality of transport are important. The duration of travel must be minimized to limit transport-induced stress for the dogs, and the most efficient and direct route available must be used.

There should be a plan that describes the frequency of providing food, water, and rest from transport for the dogs, based on the individual dogs and type and duration of transport; however, it is recognized that receiving institutions may have limited control when dealing with a transport company. The entire process should be documented, including any provision of food, water, and rest, to gather evidence for evaluating and mitigating risks for future dog transport and negotiating with transport companies.

Since dogs are prone to nausea and vomiting during transport, food and water requirements during transport must be carefully evaluated, and guidelines for normal housing adapted as necessary. In addition, the transport environment may be dry, which can contribute to increased dehydration.

During transport, adult dogs should be given water at a minimum of every 12 hours and can be fed at intervals of up to 24 hours, with sufficient rest time provided to allow for food to be absorbed before proceeding with transport (Swallow, 2005; Field and Jackson, 2006; MacArthur Clark and Pomeroy, 2010). Due to the stress of transport and the environmental conditions, water may need to be provided more frequently. Puppies must be provided with food and water more frequently than adults, depending on their age and size (MacArthur Clark and Pomeroy, 2010; Field and Jackson, 2006). As a general guide, puppies less than 4 months old or weighing less than 2.2 kg should be given water every six hours, and puppies less than 12 weeks old should be given water every four to six hours. If feeding is indicated, dogs should be given their normal diet, with the quantity limited to avoid vomiting (Swallow, 2005).

When water is provided for dogs during transport, it should be provided in a spill-proof container or at intervals between sections of transport (MacArthur Clark and Pomeroy, 2010). When spill-proof containers are used, the dogs must be trained to use them in advance. Food and water containers should be attached to the shipping container in a manner that allows them to be filled without opening the container.

Air transport must follow relevant regulations. For ground transport, vehicles must have mechanical ventilation and independent temperature control that can be operated when the vehicle is not in motion (Swallow, 2005). Atmospheric conditions (e.g., temperature, humidity, and air quality) should be kept within a comfortable range for the dog at all phases of transport, based on their age, breed, health condition, size, and coat. This is a particular concern for young puppies and thick-coated dogs as they are unable to thermoregulate as well as thin-coated adults. Containers should be firmly secured within the vehicle (Swallow, 2005).

During ground transport, vehicles should stop to allow personnel to check the dogs every two to three hours. Water, food, and clean bedding should be carried in case of delays. Opportunities for rest from transport, exercise, and elimination should be provided where possible; however, this could add variables to the intended scientific activity or negatively impact the welfare of purpose-bred dogs through exposure to unfamiliar surroundings.

4.3 RECEIVING ANIMALS

Prior to receiving dogs, the required number of clean enclosures with suitable bedding must be prepared, and arrangements must be made to feed and water the dogs upon arrival (Prescott et al., 2004). The food should be the same as that provided at the previous facility (Prescott et al., 2004). In general, changes in a dog's diet should be gradually transitioned over a minimum of seven days; however, this should be based on an assessment of the individual dog (WSAVA, 2011).

Upon arrival, dogs must be systematically evaluated, as described in an SOP. The evaluation must be conducted by a veterinarian or a person authorized by the veterinarian who can escalate concerns to a veterinarian when necessary.

A behavioural assessment should be made to determine the dog's level of arousal, fearfulness, discomfort, anxiety, and stress, and any necessary mitigation should be provided (e.g., medication, enrichment, or human contact). Client-owned dogs are not expected to undergo the type of behavioural assessment required for animals procured by the institution. However, client-owned dogs should be assessed to determine their behavioural suitability for the scientific activity they will be used in.

To limit potential transfer of infection, client-owned dogs should not be held with other dogs in the facility (Prescott et al., 2004).

4.4 QUARANTINE AND ACCLIMATION AFTER RECEIPT OF ANIMALS

The length of the quarantine and acclimation period depends on the source of the dogs, the distance and method of transport (Prescott et al., 2004), and the receiving institution's biosecurity measures. Dogs from reliable suppliers with good health surveillance programs generally acclimate within one to two weeks, while dogs from other sources often take longer (Field and Jackson, 2006).

4.4.1 Quarantine

Newly arrived dogs must have their health assessed, with identification and treatment of any parasites and the provision of relevant vaccinations. Depending on the source of the dogs and the potential for infectious disease transmission, the veterinarian will determine the procedures and duration for quarantine. While in quarantine, dogs must be observed twice daily, with a complete veterinary examination carried out at the end of the quarantine period.

The quarantine area should be separated from other animal housing to minimize the potential for cross-contamination (see Section 2.4, “Quarantine Areas”).

During quarantine, the dogs’ welfare needs must be met by replicating their regular housing and husbandry as closely as possible, while minimizing the potential spread of infectious pathogens. Since newly arrived dogs are kept separate from other dogs in the facility, unless they arrive in a group that can be quarantined together, their mental health should be addressed by providing social enrichment through human social interaction.

The quarantine period could include acclimation if the quarantine area and conditions are representative of the dog’s future housing.

4.4.2 Acclimation

Newly acquired dogs should be fully acclimated to the facility prior to being included in a scientific activity. The length of the acclimation period is situation-specific and will vary according to factors such as the type and length of transport and the dog’s previous history. The acclimation period should be determined through close observation of animal-based outcomes (see Section 8.1, “Welfare Indicators”). By the end of the acclimation period, dogs should have normal eating and drinking behaviour, be fully transitioned to the facility diet, use the automatic drinkers or bowls provided, be in good general health, and show signs of positive welfare (e.g., coming to the front of the enclosure to greet personnel and showing postures indicative of positive welfare). Additional acclimation specific to the scientific activity in which each dog will be used is described in Section 7.1, “Training”.

5 BREEDING

As stated in the [CCAC guidelines on: procurement of animals used in science](#) (CCAC, 2007), “in-house animal breeding colonies should only be established when absolutely necessary, and should be efficiently managed, consistent with anticipated need and the principle of reduction.” If external sources of dogs do not have well-developed socialization and training programs, in-house breeding may be preferable.

Guideline 5

Breeding must be managed according to approved animal use protocols, anticipated needs, and the Three Rs principles.

In-house breeding of dogs must be approved by the animal care committee and conducted in species-appropriate housing and conditions. It must only be undertaken in institutions with the infrastructure to support it and with competent, experienced personnel who maintain high standards of care.

This section provides an overview of the factors that come into play when breeding dogs; however, breeding is complex. A veterinarian should be consulted during the planning stage and be involved at each step of the breeding process. A veterinarian must be available to respond quickly if necessary, and dogs must be monitored to identify critical times when a veterinarian must be available. Such monitoring includes taking the dog’s temperature as an early indicator of parturition, a stage for which a veterinarian must be available in case of emergency.

Useful references to consult as a starting point when initiating dog breeding include the CVMA’s *Responsible Breeding of Companion Animals* (CVMA, 2024a), *Canine Reproduction: The Breeder’s Guide*, 3rd ed. (Holst, 2011), and *Canine Care Certified Standards* (Croney, 2013).

5.1 BREEDING AGE AND FREQUENCY

Prior to breeding, each dog must be assessed by a veterinarian (Prescott et al., 2004), as described by the CVMA (2018).

The appropriate age to start breeding depends on the dog breed and the stage of sexual maturity (CVMA, 2018). For small-breed dogs, breeding should be initiated no earlier than the start of the second heat cycle. For large breeds with less frequent heat cycles, breeding can be initiated at the first heat cycle if the dog is at least two years old (CVMA, 2018).

As dogs age, their reproductive success decreases, and there is an increased risk of complications associated with the birthing process (CVMA, 2018). The age of retirement from breeding varies by breed and health status; however, any dogs that experience discomfort or pain during breeding or develop signs of transmissible disease must be retired from breeding (CVMA, 2018). In general, females should not be bred after six years of age without veterinary approval (Croney, 2026). With veterinary approval, this can be extended

to eight years of age for small breeds; however, it should not be extended for large breeds (CVMA, 2018). Males should not be bred after 7 years of age without veterinary approval (Croney, 2026), and this should be limited to a maximum of 12 years of age with veterinary approval (CVMA, 2018).

The number of times a dog can be bred depends on the dog's physical, mental, and reproductive health (CVMA, 2018). Reproductive complications can be persistent and potentially worsen with age (CVMA, 2018). Dogs should not be bred more than once every 12 months, and there should be a maximum of six litters (Croney, 2026).

All in-house breeding of dogs must be carefully managed to meet the requirements of the institution's scientific activities, prevent inbreeding, and avoid overpopulation. Those responsible for breeding dogs should have a good understanding of the estrous cycle and use that knowledge to manage their breeding program and ensure realistic expectations. The selection of individuals for breeding should be informed by their genetics to minimize inbreeding. Dogs should also be selected according to temperament (i.e., breed dogs that are well-suited to the environment of the scientific activities). Dogs that have known inherited disorders or have had prior complications related to breeding should not be bred (CVMA, 2024a). Databases for purpose-bred dogs (e.g., the International Working Dog Registry) can be helpful in selecting dogs and identifying concerns.

For some scientific activities, dogs are bred to produce offspring with a particular genetic defect. Whenever breeding is anticipated to produce offspring with health problems, there must be scientific justification provided to the animal care committee, along with mitigation strategies to minimize the effects.

If artificial insemination is required, it must be justified to and approved by the animal care committee, with the procedures described in the animal use protocol.

5.2 PREGNANCY

Ultrasound should be used to determine pregnancy (Prescott et al., 2004). Other methods are available (e.g., blood tests and radiographs); however, the veterinarian should be consulted regarding their application to the breeding goals.

Pregnant females should be pair-housed or group-housed, with regular monitoring for signs of negative welfare indicators. In addition to affecting the female's welfare, in many species, maternal stress has been shown to negatively affect the offspring's development through altered hormone levels and reduced maternal care following birth (Romaniuk et al., 2025). Within a few days prior to whelping, they should be housed separately but have sensory contact with other females and daily contact with personnel.

The amount of food and water must be increased during the last three to four weeks of pregnancy. The body condition of each pregnant female should be monitored to determine the correct amount of food and water to provide. However, body condition is not an immediate indicator, and as a starting point, caloric intake should increase to three to four times the normal amount at three to four weeks post-partum when milk production peaks (MacArthur Clark and Pomeroy, 2010).

5.3 PARTURITION

A monitoring plan for parturition must be in place. Competent personnel must be available to monitor the dogs prior to and during parturition, including during off-hours, and a veterinarian must be available

in case of emergency. Signs of pending parturition should be recognized to provide each pregnant female with privacy and to aid in whelping if necessary. The dog's temperature should be monitored as a potential predictor of whelping.

To reduce anxiety and disruption, females and puppies should be in a low-traffic area away from the main primary enclosure. Pregnant females should always be allowed to whelp in isolated enclosures that are kept at 26-30°C (Prescott et al., 2004).

Opportunity must be available for the dam to move away from her puppies, such as by providing a raised platform (Prescott et al., 2004). Approximately three days after parturition, dams should be given the opportunity for short periods of exercise (Prescott et al., 2004).

5.4 CARE OF PUPPIES

Newborn puppies must be kept warm. They require higher ambient temperature than adults, generally 26-28°C for the first 5-10 days (MacArthur Clark and Pomeroy, 2010). A localized heat source, such as a heat lamp, should be provided to allow puppies to keep warm, while allowing the dam to choose an environmental temperature through behavioural thermoregulation.

Puppies should be examined by a veterinarian immediately for obvious congenital defects. If any abnormalities are detected, mitigation measures must be put in place to minimize potential adverse effects on the animal's welfare (Prescott et al., 2004).

Puppies should be checked and weighed daily to ensure they are able to feed and are growing. Dams should be checked to ensure they are producing milk.

Excretion of urine and feces in puppies up until two to three weeks of age usually requires stimulation through maternal licking of the anal and external genital regions. In hand-reared puppies, stimulation of these areas by periodic stroking with moist, warm gauze helps facilitate elimination.

5.5 WEANING AGE

Decisions about weaning age must take into account the importance of bonding between the dam and her puppies, the impact of early weaning on puppy development, and the potential for trauma to the dam's mammary glands as the puppies' teeth develop. The importance of maternal care during early life on puppies' physical and behavioural development is demonstrated by multiple studies; for example, Foyer et al. (2016), Pierantoni et al. (2011), Slabbert and Rasa (1993), and Tiira and Lohi (2015).

Puppies should not be separated from their dam until they are eight weeks old. During this time, the dam must be provided with the opportunity to isolate herself from her puppies, and she should be checked for mammary gland trauma. As the puppies approach six weeks of age, the possibility of trauma will become more likely.

The transition to food should be gradual and involve a period of semi-liquid food. The specific details of the transition depend on the puppies' size and breed.

5.6 DEVELOPMENT AND SOCIALIZATION OF PUPPIES

For dogs, socialization refers to the learning process for acquiring skills to effectively interact with their social group and the environment (Vaterlaws-Whiteside and Hartmann (2017). This is facilitated through social interactions with other dogs and people, as well as exposure to various forms of environmental stimuli (Vaterlaws-Whiteside and Hartmann, 2017).

As noted in Section 1.3, “Behavioural and Social Development”, socialization of puppies is key to their acquisition of skills for lifelong functioning (Dietz et al., 2018). Negative or traumatic experiences, including a lack of stimuli as a puppy, can have long-term negative effects on the dogs’ welfare (Dietz et al., 2018), and a lack of socialization during the first three months of life can result in behavioural problems (e.g., fear, avoidance, and aggression) in adult dogs (AVSAB, 2008).

The dam introduces her puppies to social interactions through both positive stimuli (e.g., tactile comfort) and negative stimuli (e.g., disciplinary actions such as growling or soft biting), and this interaction should be facilitated at least until the point of natural weaning (Wilsson, 1984; Case, 2005, cited in Dietz et al., 2018). While this phase is important to the puppies’ development, personnel must not emulate the dam by providing negative stimuli to correct the puppies’ behaviour.

Guideline 6

Facilities raising puppies must develop a systematic socialization program aimed at the dogs’ current and long-term physiological and behavioural development.

Examples of evidence-based socialization programs and systems for evaluating success are provided by Vaterlaws-Whiteside and Hartmann (2017) and Meunier (2006). During the first three weeks of a puppy’s life, they rely mainly on their sense of touch and are fully dependent on their dam’s care; gentle handling at this time can provide positive welfare benefits later (Howell et al., 2015). From 3 to 12-14 weeks of age, puppies engage in play with littermates and develop fear responses. Positive interaction with people and new experiences are important during this stage to alleviate avoidance and fear responses as the dogs age (Howell et al., 2015). During the juvenile period (12-14 weeks of age until maturity), it is important for dogs to continue having positive experiences in situations that they will encounter later in life (Howell et al., 2015).

While the importance of maternal care early in life has been recognized, there is also evidence that when dogs are to be rehomed, those rehomed at 9-13 or 13-16 weeks of age may be prone to more avoidance and aggressive behaviour at 1 year of age than those rehomed at 8 weeks of age (Jokinen et al., 2017). This suggests that the rehoming of dogs must take into account both the amount of maternal care and the optimal timing of the introduction to a new environment (Dietz et al., 2018).

5.7 RECORD KEEPING IN RELATION TO BREEDING

For dogs involved in breeding, there must be records of the daily observations, health assessments, and welfare assessments. Detailed records must be kept of any deaths and their cause. These records should be regularly reviewed to inform measures to be taken to minimize future morbidity and mortality (Prescott et al., 2004).

The following information must also be kept in the breeding records:

- genetics and crosses
- gestation length and any issues with the dam
- parturition length and any issues with the dam
- number of puppies at birth and number of puppies at weaning
- puppies' weights and growth rates
- lactation issues
- weaning age
- socialization activities or other human-animal interactions for the puppies
- any personality or temperament tests for the puppies

HUSBANDRY

The [CCAC guidelines: Husbandry of animals in science](#) (CCAC, 2017) should be consulted for general guidelines applicable to all species. This section provides additional considerations specific to dogs. For routine husbandry activities (e.g., checking the water supply), SOPs should be developed and followed to ensure consistency and proper record keeping.

6.1 IDENTIFICATION

The type of identification used for dogs depends on the context, including the size of the colony, the ability to visually identify each individual dog, and the type of scientific activity the dogs are used in. An invasive identification method may not always be indicated; in some situations, visual identification, aided by pictures, may be appropriate.

Microchipping is the preferred method when a permanent identification method is required. However, if a dog already has another form of identification, microchipping may not be necessary. Tattoos are also acceptable. For large colonies, electronic tagging provides quick animal identification, whereas checking tattoos can be more cumbersome. Microchipping is preferable when a dog is to be adopted following the scientific activity.

Both tattooing and microchipping must be performed by competent personnel to minimize pain. Additional measures for pain control should be applied if there is an overall welfare benefit (i.e., the benefit outweighs any negative experiences from the application of pain control). Microchips have been known to migrate, but the incidence of microchip loss or failure is very low (MacArthur Clark and Pomeroy, 2010; Prescott et al., 2004). Tattoos may be used as a backup; however, collars can also provide a secondary form of identification.

Puppies can be temporarily identified by shaving a small spot on their fur, and this can remain visible for several weeks.

6.2 ANIMAL OBSERVATION

The frequency and level of observation should be based on a risk assessment; however, all dogs must be specifically and systematically observed at least twice daily by trained personnel who can recognize behavioural, physical, and psychological signs of positive and negative dog welfare (see Section 3.7, “Personnel”).

The twice-daily observations must include the following:

- enclosure-side observation of behaviour
- general assessment of the dog’s condition and response (e.g., alertness and responsiveness, normal breathing rate, indicators of good welfare, and absence of stress indicators such as restlessness or panting)
- assessment of the dog’s food and water intake, urination, and defecation, as indicators of health
- observation of the dog’s environment (e.g., availability of water)

The welfare indicators described in Section 8.1, “Welfare Indicators”, provide a good foundation for daily observations. A change in a dog’s behaviour is an important indicator and should lead to increased monitoring and a mitigation plan.

A record must be kept of each daily observation to indicate that the animals were observed and found to be normal or that concerns have been identified. Concerns must be reported to the veterinarian. Each institution should determine the level of detail to be recorded. For example, a general scheme could be developed that ranks indicators as red, yellow, or green according to the level of risk to the animals and the urgency for follow-up action. An example of a monitoring sheet that could be used as a starting point is available on the NC3Rs website (Hall et al., 2022).

In addition to the twice-daily welfare observations, there will be husbandry activities that involve further interaction and observation of dogs (e.g., cleaning enclosures and environmental enrichment) where informal monitoring should take place. Observations during these activities are typically not recorded unless a concern arises.

Increasing the frequency of personnel being present in rooms or enclosures with dogs can reduce the dog’s response when people enter the room, which can improve monitoring by providing a more accurate representation of the dog’s normal behaviour. This, coupled with frequent observation of the dogs, can improve the ability to detect subtle changes in the dog’s behaviour (Hall et al., 2022).

Common problems that could occur if dogs are left unattended include lack of access to water (due to water bowls being overturned or dogs chewing off the cord to a guillotine door that leads to water access), fights between dogs, and ingestion of objects.

6.3 HOUSING MANAGEMENT

Breed differences and individual differences must be taken into account in all aspects of the housing management of dogs.

6.3.1 Barking

Barking is an important behaviour for communication among dogs and a means of conveying information; however, it is also a major source of noise in dog facilities that can negatively impact dogs and people (see Section 3.4, “Sound and Vibration”). In addition to addressing this through facility design (see Section 2.1, “Sound Control”), management practices to reduce barking should reflect the dog’s motivation to bark. Possible strategies may include housing dogs that are highly motivated to bark separately from dogs that are less motivated to bark, while still meeting their social housing requirements, to limit barking in response to the barks of others; and reducing other stimuli that elicit barking due to frustration and excitement (e.g., exposure to other dogs playing, food preparation, and other dogs walking past the enclosure).

6.3.2 Social Interaction

The housing management strategy should address the welfare of the individual dogs (see Section 8, “Welfare Assessment”). Justification for the individual dog’s housing strategy should be described in each individual dog’s file (e.g., explain why particular dogs are together or apart) and tracked over time.

Dogs should be socially housed. Social housing can have welfare benefits (Hecker et al., 2024) and is generally preferred by dogs. See Section 6.3.3, “Establishing Compatible Pairs or Groups or Introducing a New Dog”, for guidance on setting up social housing. However, it should be recognized that some dogs do not want to be pair- or group-housed. Even if there is no aggression, they may have a preference not to live with other dogs. As noted in Section 2, “Facilities”, housing should be designed to accommodate diverse needs and be flexible enough to accommodate a range of possibilities for each dog. It should also allow for changes to be made as a dog’s needs change.

Pairs or groups of dogs should be kept stable to avoid aggression (RSPCA, 2011), and an evaluation of compatibility should be conducted on an ongoing basis (Prescott et al., 2004). Aside from a lack of aggression, there must be evidence that all dogs are able to access sufficient quantities of food, water (see Section 6.4, “Nutrition, Feeding, and Water”), and other resources to meet their individual needs, move about the enclosure freely (i.e., no avoidance, competition, or fearful behaviours), rest, and engage in reciprocal play. The dogs’ reproductive status should be factored into social housing decisions (e.g., intact males and females, and females in late-stage pregnancy); however, their reproductive status alone is not justification for single housing. Housing for groups of dogs may call for additional space per animal and multiple escape routes and structural barriers, to allow dogs to avoid aggression from other dogs should it occur.

Dog enclosures within a room should be located to limit the influence of aggressive dogs over more submissive dogs. Visual barriers between certain dogs may help minimize this influence.

Scientific activities should be designed to accommodate social housing. If single housing is justified, it must be for the shortest time possible, and the dog must have the option for visual, olfactory, and auditory contact with other dogs when in their enclosure. Singly housed dogs should be provided with opportunities to socialize (e.g., through visits to exercise and play areas during cleaning) and have regular contact with people. The level of contact required will vary among dogs. Each dog’s behaviour should be assessed to indicate how that animal is coping and whether the level of contact meets their needs. The aim is to avoid feelings of loneliness and isolation for the dog. The dog should appear content and not show signs of negative welfare (see Section 8, “Welfare Assessment”), such as excessively trying to solicit attention in a manner indicative of stress.

If a dog is incompatible with other dogs, there could be welfare issues that can be addressed in ways other than through separation. When aggressive interactions occur, dogs should be separated immediately, and mitigation strategies applied to reintroduce them. The context of the situation must be evaluated to determine potential mitigation strategies, as each situation is unique. Examples of mitigation strategies that could be used include:

- using positive reinforcement methods to improve social interactions (see Section 7.1, “Training”)
- providing more space and sufficient resources (sleeping areas, food, etc.) to avoid competition
- seeking the assistance of an animal behaviour professional to attempt to match dogs with compatible personalities and introduce the dogs gradually (as described in Section 6.3.3, “Establishing Compatible Pairs or Groups or Introducing a New Dog”)
- using pharmacological interventions to reduce aggression, when prescribed by the veterinarian

The mitigation strategy will vary with the situation and factors such as the animal’s history, the type of housing, and the type of management. When implementing mitigation measures, welfare indicators for each individual dog should be monitored closely.

6.3.3 Establishing Compatible Pairs or Groups or Introducing a New Dog

There must be a process for introducing unfamiliar dogs to each other if they are to be housed together. Creating a pair or group of dogs or introducing an animal to an existing group is a gradual process that requires a detailed plan and takes into account the characteristics of the individual animals. The safety of each animal is important when pairing or grouping dogs, and the pairing or grouping process should be supervised by experienced personnel.

For adults, the plan should include a very gradual, stepwise introduction of the dogs, starting with protected contact and eventually ending with unprotected contact in a neutral area. The first step should be to house the dogs in close proximity with visual but no physical contact, and to observe them for affiliative or aggressive behaviour. If their response is positive, the dogs can be moved to a situation of protected physical contact (e.g., through wire mesh or perforated panels) with continued observation by personnel. If the response remains positive, the dogs can be introduced to full contact under direct observation by personnel who are prepared to intervene and separate the dogs if any welfare concerns arise. Minor displays of aggression should be monitored but may not require intervention. A dog should not be moved into the enclosure of another dog, but rather the dogs should be introduced in a neutral environment or by opening a divider between their adjoining enclosures.

If dogs are leash trained or have had positive reinforcement training, they can be introduced gradually on a leash. Trainers should work with each dog independently in a neutral location and use high-value treats to reinforce the dog's focus on the trainer. The dogs are initially kept far apart, and over time, the distance between them is gradually reduced, provided they remain calm (see Ramirez, 2019).

There are limited evidence-based resources for managing dog playgroups. However, some information for establishing and maintaining dog playgroups is provided by the Shelter Playgroup Alliance (SPA, 2019) and The Pet Rescue Resource (TPRR, n.d.).

6.3.4 Feeding Behaviour

The housing management plan must accommodate the dogs' feeding behaviour and their health status. The plan must also address the potential for aggression and competition among socially housed dogs to ensure each dog's needs are met.

The natural feeding behaviours of dogs are described in Section 1, "Introduction", and range from scavenging small meals of variable composition among free-ranging dogs to hunting and consuming prey animals on a less predictable basis for wolves. While the situation for dogs in laboratories is very different, strategies to elicit scavenging behaviour or variability in feeding could provide environmental enrichment, including psychological stimulation.

6.3.5 Space Requirements

The housing management plan must address the availability of space and furnishings to accommodate behaviours important to dogs (see Section 2.2.1, "Spatial Requirements", and Appendix 1, "Dog Housing and Management System Assessment Tool").

6.3.6 Use of Objects

The housing management plan should include the addition of objects for dogs to manipulate, suited to the breed and age of the dogs, and plans for object rotation or replacement to sustain interest. The risks of providing objects (e.g., injury, swallowing of the object, and intestinal obstruction) must be assessed for each individual dog, and the objects must be deemed safe. As noted in Section 9.1, “Disease Prevention”, objects should be sanitized or replaced as necessary to maintain a healthy environment for the dogs.

6.4 NUTRITION, FEEDING, AND WATER

Guideline 7

The nutrition and feeding of dogs should follow current science-based standards.

6.4.1 Nutrition

The diet should meet the dog’s nutritional requirements and be compatible with the scientific activity. Diets should be designed to follow the National Research Council and Association of American Feed Control Officials guidance for dogs. Diets have been designed for various life stages, including pregnancy, lactation, growth, and aging, and should be given to dogs accordingly. The diet of each dog should maintain an optimal body condition score. Awareness of the potential for variability in the food formulation is also important for some scientific activities. Client-owned dogs should remain on their usual diet for short stays to avoid gastrointestinal upset.

Dogs held at institutions should not be fed raw meat, as it poses health risks (e.g., Salmonella and Campylobacter) for dogs and people, particularly for immune-suppressed animals. Because the diets of client-owned dogs and shelter dogs cannot be controlled, when these dogs enter scientific facilities on a temporary basis, the risks associated with their potential consumption of raw meat should be evaluated, and mitigation measures should be implemented as necessary to protect other dogs and people.

Individual dogs vary in food preferences, and feeding programs should aim to accommodate these with regard to palatability and satiety. While dry food is generally better for dental health (Watson, 1994) and ease of storage (Field and Jackson, 2006), dogs show a strong preference for meat and moist food over dry food (Prescott et al., 2004).

Some dogs benefit from changing the type of food (e.g., novel flavours), while others either do not care or experience stress or digestive problems when their food is changed. Variation can be provided in the type of food (i.e., different odours, flavours, textures, shapes, and sizes) or in the presentation of food to add physical and mental stimulation (Prescott et al., 2004).

Maintaining variation in a dog’s diet can compensate for changes that might occur in the formulation of a particular dog food. Additionally, if dogs are fed the same food over time, it can be stressful for them if the food needs to be changed. When a dog’s diet is changed, it should be done gradually over 7-10 days.

6.4.2 Feeding

Regular feeding times should be established for dogs, preferably twice per day, unless feeding is used as part of an enrichment program or scientific justification for a different schedule is provided to, and approved by, the animal care committee. Dogs should be fed more frequently during pregnancy and lactation. In all cases, consistency in feeding times is important for the dogs' welfare and for scientific activities. Feeding dogs twice a day aligns with their natural scavenging behaviour; however, research on optimal feeding is ongoing (e.g., Bray et al., 2022). Any changes to feeding routines based on longevity studies (e.g., Bray et al., 2022) must also include evaluation of the effects of these changes on health and behaviour (e.g., hunger).

Food is typically fed at discreet mealtimes in bowls; however, it can be offered in other ways for enrichment (see Section 6.6, “Environmental Enrichment”). Food is a powerful motivator and can be used as a reward to positively reinforce desirable behaviours. Even the daily feeding routine can be incorporated as a training tool (see Section 7.1, “Training”). When provided by hand, food can improve the human-to-dog bond. When providing preferred foods as rewards or treats, they should align with the veterinarian's advice and be part of the overall nutritional plan for the dogs.

Animal-based measures should be used to guide feeding practices based on the breed and individual dogs, with the aim of all dogs having an optimal body score and appropriate social interactions during feeding. Any observed change in an individual dog is an indicator of a potential problem and may be more critical than their body score. Food-related aggression can potentially be controlled by training to promote behavioural change and avoid separation of the dogs (Mehrkam et al., 2020).

Puppies typically begin eating moistened or dry food at about four weeks of age. Feeding can be encouraged by adding water to dry food at a 1:1 ratio. Puppies should initially be fed three times daily, and this can be reduced to twice daily as they grow. The feeding schedule will vary according to the situation (e.g., the specific requirements of puppies can vary from week to week) and should be managed through animal-based measures such as weight. For information and resources see the American Animal Hospital Association and the *WALTHAM™ Puppy Growth Charts* (Waltham, n.d.).

Dry food contributes to good dental health. Providing it ad libitum encourages slower feeding; however, ad libitum feeding should generally be avoided for adults, except for lactating females and dogs with high nutritional energy needs, as it may lead to obesity.

Feeding practices should be adapted to the needs of the individual dogs. Decisions about feeding dogs separately or in a group depend on whether the individual dogs can calmly eat their full portion without fearing an aggressive encounter or needing to rush. An aggressive response can occur because a dog views the food as a valuable resource that is under threat. The speed of eating could be a symptom of a problem, and the dog may need to be singly housed, at least during feeding. However, the breed of dog should also be factored in, as the rate of eating can be strongly linked to breed.

While dogs on restricted feeding are often housed separately during feeding, it is preferable to keep them together, if possible, and provide a food bowl for each dog in a separate area of the enclosure. If dogs must be separated during feeding, it should only be for the time necessary to consume their food (Prescott et al., 2004).

Food aversion can happen if a food is associated with a negative physiological response, such as food that was mixed with a drug and produced unpleasant side effects (Prescott et al., 2004), or if food is used as a bribe for aversive treatment (e.g., luring a dog into an aversive environment). For these situations, it should be assessed whether using a different food from their usual diet or using high-value treats is beneficial.

Any changes to the feeding schedule must include close monitoring of the dogs to ensure they are acclimating and eating a sufficient amount of food. The frequency of body weight measurements and food intake measurements should be increased until there is evidence that the dogs are feeding appropriately.

6.4.3 Water

Dogs should always be provided with clean, potable water ad libitum (Field and Jackson, 2006; Prescott et al., 2004). Dogs require approximately 70-80 mL of water per kg of body weight per day in a temperate environment (Prescott et al., 2004). Animal care personnel must look for behavioural signs of thirst (e.g., panting, low energy), and not just dehydration, as an indicator that the dogs are not consuming an adequate amount of water. Regardless of the system used, every dog must be monitored to ensure they are drinking a sufficient amount of water, and that water sources allow access and prevent intentional or unintentional blocking by other dogs.

If water is supplied through an automated system, scheduled checks should be performed to ensure the system is functioning properly (Prescott et al., 2004). Water pressure must be checked regularly, as low pressure can lead to insufficient water delivery at the end of the system. Over-pressurization can also be a problem, as dogs may get sprayed when trying to drink and will be unable to consume an adequate amount, potentially developing an aversion to the system. Dogs new to automatic watering systems or those experiencing physical difficulties must be carefully observed to ensure they can access the water and are drinking the quantity that they need.

If bowls are used, they must be washed and refilled regularly. It is useful to affix water bowls to the side of the enclosure so they cannot spill and can be cleaned and refilled without entering the enclosure. Water bottles are also used in some facilities and are necessary for particular scientific activities. Bottles do not have as much pressure as automatic systems.

6.5 PHYSICAL ACTIVITY

Physical activity usually involves dog-to-dog play and dog-to-human interaction. Dogs must be provided with the opportunity and stimulation to engage in daily physical activity in the form of natural locomotor activities appropriate for the dog's age, the animal model being studied, and any scientific procedures underway. Housing should allow an opportunity for such physical activity on an ongoing basis (see Section 2.2.1, "Spatial Requirements"). However, there are situations in which particular forms of physical activity are not appropriate. Additionally, some dogs may not engage in physical activity when given the opportunity, and efforts should be made to encourage them to be active without using any force.

All dogs, regardless of their housing, should have regular physical activity outside of their primary enclosure; however, if the primary enclosure is large enough for dogs to perform natural locomotor activities (see Section 2.2.1, "Spatial Requirements", and Appendix 1, "Dog Housing and Management System Assessment Tool"), an exercise area is not mandatory. Since exercise outside of the primary enclosure also provides dogs with an opportunity for human interaction, if the exercise area is incorporated into the primary enclosure, sufficient human interaction must be provided in other ways (see Section 6.7, "Human Contact and Handling").

The extent of the physical activity outside of the primary enclosure that is required depends on the opportunities available within the primary enclosure. However, exercise periods outside the primary enclosure

present physical and mental stimulation and should be provided daily (Prescott et al., 2004), even when an exercise area is not mandatory. This can include walking the dogs on a leash.

When dogs are taken out of their primary enclosure for activity, personnel must be present to provide positive interaction with the dogs, encourage use of the available resources, and effectively deal with any aggression that may occur (RSPCA, 2011).

Group interactions for exercise and play areas involve careful planning and observation to ensure that compatible groups are together. Social interactions should be monitored by animal care personnel to ensure they provide benefits to all dogs, especially when groups are mixed. The sex of the dogs within groups should also be taken into account. Behavioural signs of negative psychological states (see Section 8.1, “Welfare Indicators”) should be used to evaluate the success of group activities (Meunier, 2006). The use of positive reinforcement techniques to reduce agonistic interactions has been shown to reduce stress in dogs and improve the welfare benefits of social play. Modifications to the furniture may encourage physical activity and provide novelty and choice.

Exercise and play areas and dog training must facilitate the retrieval of dogs in a manner that is safe for the dogs and personnel.

6.6 ENVIRONMENTAL ENRICHMENT

Environmental enrichment is the provision of stimulating and responsive environments (Shepherdson, 1998) above the basic conditions that meet the animal’s physical, physiological, and psychological needs. Modifications to an animal’s environment should focus first on the specific needs of each animal (i.e., those physical and behavioural needs for which some degree of negative welfare would occur in their absence) and then on enriching the animal’s environment in a manner that provides positive welfare benefits (Weary, 2012). Environmental enrichment for dogs should focus on opportunities to express species-typical, non-injurious behaviours beyond those that address basic needs and should allow dogs a degree of control and choice in their behaviour.

A robust environmental enrichment program must be provided that addresses individual dogs’ needs and aligns with the scientific activity. A robust enrichment program will incorporate enrichment interventions that satisfy a range of needs in the social, food-based, physical and structural, cognitive, and sensory domains (see examples below). Individual dogs have preferences for different types of enrichment, and animal care personnel should provide enrichments that have meaningful benefits to each individual dog. A starting list of enrichment options can be found in Meunier (2006). Scientific activities may also be a source of enrichment; for example, allowing a dog to explore a new environment, or positive reinforcement training for the procedures (Meunier, 2006).

Environmental enrichment should be an ongoing process that includes an evaluation of the welfare benefits to the animal and the impact on the scientific activities (Baumans and Van Loo, 2013), and it should involve a team approach involving animal welfare scientists, protocol authors and their teams, veterinarians, animal care personnel, and animal care committees. It is important to acknowledge individual differences among dogs, as items and practices intended to provide environmental enrichment may not be perceived as positive by all dogs.

Dogs provided with appropriate enrichment have shown substantial changes in behaviour, with an increase in the complexity of behaviours and a decrease in undesirable behaviours (Hubrecht, 1993). There is

abundant evidence that providing dogs with appropriate objects and opportunities can enhance their well-being and promote desirable behaviours. Studies have shown enrichment to result in increased indicators of positive affective state (e.g., tail wagging, decreased rate of stereotypies, reduced cortisol, more friendly behaviours) (Normando et al., 2009). Puppies that are exposed to a complex environment have been found to be less fearful of new stimuli when they are older (Prescott et al., 2004). In addition, more enriched environments likely result in normal behavioural and brain development, thereby improving the quality of scientific activities (Würbel, 2002).

The minimum standards found in traditional dog housing often do not provide sufficient stimuli and space for dogs to perform natural behaviours. Dogs kept in low-stimulus environments show more indicators of negative affective states, such as excessive fear or aggression, increased autogrooming, vocalizations, passiveness, stereotypies, and increased coprophagy (Hetts et al., 1992; Hubrecht et al., 1992; Beerda et al., 1999).

An assessment must be made of the safety of any environmental enrichment in terms of the risk of injury, ingestion of a foreign body, etc. The animal's response to any initiatives should be monitored to determine which initiatives the animal prefers, avoids, or ignores. Observation and documenting findings are key to the process. When implementing new enrichment plans, pre-and post-intervention data should be collected. Typical measures include physical well-being (e.g., normal weight gain and food consumption, no illness or injury), activity budgets (e.g., range and frequency of species-typical behaviours and levels of abnormal behaviour), utilization of the captive environment, and response to challenges or stressors.

6.6.1 Social Enrichment

As noted in Section 1.3, “Behavioural and Social Development”, dogs are social animals. As a basic requirement, they should be housed in pairs or groups according to their individual needs (see Section 6.3, “Housing Management”). Social enrichment involves additional sensory contact (visual, auditory, olfactory, or tactile) with other animals or people.

6.6.1.1 Interaction with People

Dogs have been bred to be with people and are different from other research animals in this respect. Interaction with people supports dogs' well-being, and opportunities for dogs to spend time with people should be maximized in terms of amount and quality, including during regular observations and husbandry activities. However, the daily time budget of each dog should be incorporated into planning. If a dog is constantly with humans, time alone may be valuable. The activity budgets of free-ranging dogs suggest that they may naturally spend over half of their time resting (sleeping, lazing, or sitting); other activities include walking in search of food and marking their territories (Majumder et al., 2014).

Interactions between people and dogs, such as through positive reinforcement training, can be an important form of enrichment for dogs. It can reduce the negative impacts of captivity and create a positive association with personnel. Interaction with a familiar person has been found to reduce stress in dogs more than the presence of a kennel mate (Hennessy et al., 2020).

The benefits of interaction between dogs and people are influenced by such factors as the nature, frequency, and duration of the interaction. Frequent human interaction in various contexts is preferable (Overall and Dyer, 2005). For more information, see Section 6.7, “Human Contact and Handling”.

6.6.1.2 Interaction with other Dogs

As noted in Section 6.3.2, “Social Interaction”, dogs generally prefer to be with compatible dogs. However, the benefits of interaction with other dogs will depend on each dog’s individual characteristics.

6.6.2 Food-Based Enrichment

Providing standard feed in a manner that mimics the dog’s natural foraging behaviour (e.g., by placing food in a decentralized manner) can provide a positive experience. Toys that incorporate food can also encourage foraging behaviour, and this can be particularly useful for dogs that are singly housed. Foods that are highly desirable, time-consuming to eat, or novel can also be provided for enrichment.

6.6.3 Physical Enrichment

Physical enrichment is in addition to the basic requirement for physical activity (see Section 6.5, “Physical Activity”) and is addressed through the inclusion of elements that increase the complexity of the dog’s environment, both in the primary enclosure and play or exercise areas. For example, structures such as plastic tunnels add complexity to the environment and can be a source of physical enrichment when used by dogs (Prescott et al., 2004).

Chewing is an important behaviour for dogs (RSPCA, 2011). The provision of chewing objects may enrich the lives of dogs (e.g., Prescott et al., 2004; RSPCA, 2011) and reduce stress (Rooney et al., 2009); however, more research is needed to clarify the role of chewing as enrichment (see Arhant et al., 2021, for a review). Chewing has been associated with negative affective states and has been suggested to be a coping mechanism for stress. Context may be important; dogs living in highly enriched environments may be less interested in items to chew (Pullen et al., 2010).

When providing objects for chewing, they should be carefully selected based on the individual dog to minimize the risk of adverse effects, such as airway or gastrointestinal tract obstruction (Arhant et al., 2021). Objects should be designed to be manipulated and allow for chewing behaviour, be large enough to prevent swallowing, and be made of a material that cannot be easily broken down into smaller pieces. Objects that are too large to be picked up with the mouth tend to be less attractive to dogs.

All objects must be safe and non-toxic. Objects and structures added to the dog’s environment should be examined regularly and removed if they have sharp edges or pose a potential of pieces breaking off. Objects and structures should be sanitized or replaced regularly to minimize risks associated with physical injury and microbiological burden, taking into account their use for scent marking.

The presentation of items can be important. Dogs may not respond to items left on the floor, but suspended objects can stimulate interest because of their unpredictable movement (Prescott et al., 2004). Food treats can be incorporated into certain types of toys to increase their value for dogs and provide cognitive stimulation.

When providing objects, the main goal is to sustain the animal’s interest. Over time, animals may lose interest in items they initially preferred. Sustained interest can be achieved by:

- using objects that the animals can manipulate and modify (e.g., destructible items such as paper, cardboard boxes, or wood), with appropriate monitoring to address the risk of ingestion or injury, as noted above
- introducing new objects regularly (rotation according to a schedule)

- linking objects to strong natural behaviours, such as eating, foraging, grooming, or locomotion and postural movements
- having personnel incorporate the item into play with the dog

Interest can be monitored over time through direct observation, video recordings, or physical evidence such as chew marks. Dogs may focus on personnel rather than objects when they are present, so direct observation of engagement with enrichment objects may not always be possible (Meunier, 2006). A sufficient number of objects should be provided in the enclosure to minimize aggressive behaviours between dogs (RSPCA, 2011).

6.6.4 Cognitive Enrichment

Cognitive tasks are an integral part of the enrichment program, whether part of a scientific activity or part of training for husbandry and veterinary care (see positive reinforcement training in Section 7.1, “Training”). Cognitive and occupational activities should promote normal behaviours that dogs are highly motivated to perform, and include objects that the dogs can manipulate or work for. Further stimulating dogs' cognitive capacities should be encouraged through tasks such as learning and memory tests, as well as by setting problems for animals to solve.

There is growing evidence that expressions of agency are rewarding for animals, independent of any functional outcome that they may have. In the wild, animals face many challenges that they are adept at responding to; some are novel, and others are not. Both require cognitive and behavioural tools and strategies. Many of these tools are based on learning from previous experiences. In captivity, basic needs are met, environments tend to be monotonous and predictable, and animals are rarely or never challenged. The benefits of providing challenges through environmental enrichment include direct rewards for the animal through the experience of addressing challenges, increased competence in meeting challenges that require skill (which is fulfilling to people and likely creates a similar state in other animals), and better health and less fear as a result of success in dealing with challenges that arise (Spinka and Wemelsfelder, 2011).

6.6.5 Sensory Enrichment

Sensory enrichment aims to trigger one or more of a dog's senses: auditory, olfactory, visual, and tactile. At a minimum, dogs should be able to have visual, olfactory, and auditory interactions with other dogs (as noted in Section 6.2, “Animal Observation”). Animals should also have the capacity to remove themselves from visual contact by way of barriers or privacy panels. Access to the outdoors should be provided to enhance sensory enrichment.

Dogs have a well-developed sense of smell and the positive and negative impacts of odours in the dog's environment must be taken into account. Burying substances with odours that are attractive to dogs can provide enrichment as the dogs work to dig them up. However, given their sensitive sense of smell, care must be taken to ensure the odours are not overpowering. A systematic review of the effects of pheromones on dogs indicates that the research is inconclusive (Frank et al., 2010), and their use is not advised.

There is evidence that music may provide enrichment for dogs and potentially reduce anxiety in stressful situations (Lindig et al., 2020). Classical music appears to provide the most benefit to dogs; however, additional research is needed to better define important characteristics of the music and how the benefits vary with the dogs' physical characteristics and past experiences (Lindig et al., 2020). Some other musical

genres have also shown benefit and can be used to reduce habituation to music (Bowman et al., 2017), which can occur within a few days (Bowman et al., 2015).

Natural light may also provide benefits (Ross and Mason, 2017).

6.7 HUMAN CONTACT AND HANDLING

As noted in Section 6.6, “Environmental Enrichment”, positive human contact can be enriching for dogs and personnel. This is an important aspect of dog husbandry. The purpose of any human interaction with dogs should be to enhance pleasure and minimize negative states of anxiety, frustration, boredom, etc. The overarching goal should be for dogs to be content, as measured by positive welfare indicators (see Section 8.1, “Welfare Indicators”). There should be a strong focus on finding opportunities to maximize the amount of time dogs spend with people; however, the amount of contact should be balanced with each dog’s needs, as described in Section 6.6.1.1, “Interaction with People”.

Human contact can have a buffering effect on the stress experienced by dogs, and this is enhanced when the interaction is conducted in a soothing and quiet manner within a secluded area occupied by only the dog and human (Hennessy et al., 2020).

Positive human contact can also reduce stress in dogs during scientific procedures (e.g., Hall et al., 2015). Habituation and systematic desensitization methods are encouraged to help dogs overcome their fear of people and to prepare them for scientific procedures. These methods should also be used to prepare dogs for routine physical exams and health procedures such as weighing (see Section 7.1, “Training”).

Guideline 8

In addition to routine daily interactions, each dog must receive varied, positive human contact.

Regular, positive human-to-dog interactions are essential to optimal dog welfare and must be prioritized. Providing a variety of positive human-to-dog interactions for each dog daily is an integral part of welfare that should be incorporated into husbandry and other routine procedures. However, there should also be planned additional human contact that is geared toward enhancing positive emotional states with individuals or groups of dogs.

The use of performance outcomes and cumulative welfare assessments by trained personnel is key to determining appropriate and sufficient human interaction. See Section 8.1, “Welfare Indicators”, for information relevant to human contact. There is evidence of positive welfare benefits for dogs that experience 30 minutes or more of interaction with people or exercise per day; however, variation in results suggests that context is a factor (Kiddie and Collins, 2015).

Handlers must be able to recognize behavioural cues and signals that dogs are experiencing negative welfare states and adjust their approach accordingly. The ability of personnel to recognize a dog’s positive and negative behavioural cues, particularly signs of fear or anxiety, and respond appropriately is fundamental to positive dog-to-human interactions. When dogs exhibit indicators of negative welfare, the person must adjust their approach to ameliorate the dogs’ negative affective states. Personnel who interact with dogs must receive relevant training and be evaluated to be competent (see Section 7.1, “Training”). While it is

recognized that people with extensive experience with dogs may be able to assess a particular dog's welfare intuitively, assessment tools are important to avoid incorrect assumptions and to guide those who are new to working with dogs. Assessment tools must reflect the dog's perspective and be based on available evidence.

Human contact can take the form of positive reinforcement training, play, relaxing with dogs, stroking, leash walking, etc. The various types of interactions cannot be evaluated independently; it is the combination of interactions that affects a dog's welfare. Even a person's tone of voice can make a difference. Activities that constitute positive human contact depend on the species, age, and individual dog.

The type of contact to be implemented must be tailored to the individual dog, the situation, and the scientific activity. Knowledge of the dog's individual preferences in relation to the type of contact is key, as particular forms of contact may not be perceived as positive by all dogs. For example:

- visual human presence without actual contact can be positive for some dogs, while it may be a negative experience for other dogs if they cannot access the person
- grooming is potentially enriching for some dogs, but many dogs do not enjoy it, and grooming can have aversive effects for these dogs
- petting may reduce cortisol concentration (Dudley et al., 2015); however, this can be affected by the manner in which petting is done (Hennessy et al., 2020)

Examples of human interaction that may create a positive environment include slow movement, a reassuring voice, crouching, and an extended hand when greeting a dog; playing, petting, and grooming the dog during socialization; and providing treats and petting prior to, and where possible, after procedures. It is important to ask for assent by allowing the dog to approach and present their body for touch rather than touching the dog without this approach. Another technique might be to pet for a few seconds and then withdraw the touch to see whether the dog leans into the hand to request more touch. If not, petting should not continue.

Play can be considered an important neurological indicator for well-being. In general, research has shown across a variety of species that animals with negative affective states play less (Held and Spinka, 2011; Ahloy-Dallaire et al., 2018), and the absence of play in young animals of normally playful species is likely a reliable sign that welfare is suboptimal (Ahloy-Dallaire et al., 2018). However, levels of play alone are not sufficient to indicate good welfare (Ahloy-Dallaire et al., 2018), and the link between play and welfare can vary between dogs, based on their previous experience and the context of the interactions (Sommerville et al., 2017). Arguments for the benefits of play are that the activity of play acts as a reward, with opioid-mediated pleasurable experiences, and play is socially contagious, so it can spread positive welfare to a larger number of individuals (Held and Spinka, 2011). There is evidence of a positive association between plasma oxytocin levels and play-soliciting behaviour and exploration in dogs (Rossi et al., 2018). Play after training events may also positively influence learning (Affenzeller, 2020).

As mentioned, human contact should focus on each dog's individual needs. However, even when efforts are made to maximize the time spent with dogs, some dogs will still suffer during times when they do not have contact with people. It is important to be aware of these situations and consult a veterinarian or behavioural specialist to determine the best way to help the dogs feel content when people are absent.

6.8 CLEANING AND SANITATION

All enclosures should be spot cleaned (i.e., cleaned of feces and urine) at least twice daily (CVMA, 2018) and kept dry and comfortable for the animals. In small enclosures, feces should be removed more frequently to ensure a clean, dry resting area is always available.

Enclosures should be sanitized at a minimum every two weeks, or more often as required to maintain the health and safety of animals. The frequency of sanitizing will vary depending on factors such as the number, age, and type of dogs, the type of bedding, and the size of the enclosure. Training dogs to eliminate in specific areas can make cleaning and sanitation procedures more efficient and prepare dogs for rehoming (see Section 12.2, “Rehoming”).

Criteria for sanitizing enclosures depend on whether new animals will be introduced or the same animals will be returned to the enclosure. Enclosures must be thoroughly sanitized and olfactory cues from other animals removed if enclosures will be occupied by different animals. The sanitation process should be monitored to ensure the required level of sanitation is achieved. It should be validated and verified regularly.

When enclosures are to be sanitized, dogs must be moved to a separate area (e.g., play area or another kennel) and not returned until the floors are dry, unless mitigation measures are put in place. This can be combined with an opportunity for exercise in a separate area (Prescott et al., 2004). Dogs must not be tied up outside of the enclosure.

During regular cleaning, if the dogs cannot be removed from their enclosure, the cleaning process (including water temperature, cleaning agents, etc.) must not be harmful to the dogs, dogs must have the opportunity to move away from the cleaning solutions (e.g., to move to an elevated resting platform), and care must be taken not to spray or otherwise disturb the dogs. Precautions must be taken to minimize the creation of aerosols while spraying enclosures.

Food and water bowls should be cleaned daily and disinfected weekly (CVMA, 2018). Waste containers, cleaning equipment, and food preparation areas should also be cleaned daily and disinfected weekly (CVMA, 2018). Storage containers for food and water should be cleaned and disinfected before being refilled (CVMA, 2018). Anything to be used for another dog must be cleaned, disinfected, and rinsed before use (CVMA, 2018).

Objects within enclosures should be sanitized at least as frequently as the enclosure. However, scent marking is an important component of natural dog behaviour, and any negative welfare impacts associated with the disturbance of scents may be minimized by offsetting the timing of sanitizing objects with when the enclosure is sanitized (e.g., sanitize the enclosure one week and enrichment items the following week), such that some scents are always maintained.

6.9 RECORD KEEPING

General information is covered in Section 12, “Record Keeping” in the [CCAC guidelines: Husbandry of animals in science](#) (CCAC, 2017).

As with other animals, dogs held in facilities must be clearly identified with the animal use protocol number to which they have been assigned, the name of the protocol author, emergency contacts, and any other relevant information (including a brief summary of any scientific procedures) in a readily accessible format close to their enclosure.

Individual animal records must be kept, indicating such information as birth date, sex, origin, physical measurements, reproduction information, health information, medical history, and nutritional history. Records of scientific activities must be kept for the entire duration the dog is at an institution and should accompany the dog if transferred to another institution. This includes complete records of all scientific procedures, as a treatment in one scientific activity may influence the animal’s response in a second activity.

A record of dogs housed in the same enclosure ensures that dogs will be socially housed with others that were confirmed to be compatible; however, these animals should still be monitored (see Section 6.3.2, “Social Interaction”).

Information gathered through welfare assessments, including details of health, behaviour, and physiology, must be documented and retained in the animal’s records (see Section 8, “Welfare Assessment”).

Documentation of daily monitoring must be tailored to the particular dogs and the situation. It should be risk-based; if there is an increased likelihood that the dogs will not do well, documentation, along with monitoring, should increase to enable a timely response when necessary.

Checklists can provide a simple, quick method for personnel to record daily observations. They allow tracking the same behaviour indicators over time so that changes and trends can be easily identified. Checklists should be designed to capture important welfare indicators efficiently, so that excessive time is not taken away from interaction with the dogs.

Any change in a dog should be brought to the attention of the veterinary team. In addition, veterinary personnel should review all information recorded for each dog weekly. A negative behaviour that happens once may not be important, but if it occurs several times, it indicates a problem that must be addressed. Review of documentation over time is particularly important if multiple personnel are recording observations, as each person may not be aware of the frequency with which a particular behaviour is displayed.

If dogs are being trained, training logs should be developed and used. It is useful to have a system of scoring each session to help evaluate the success of the training and potential changes in dog welfare.

7 TRAINING AND RESTRAINT

7.1 TRAINING

This section is intended as a general overview of concepts that should be incorporated into an animal training program and provides basic descriptions of training methods. It is not a comprehensive dog training guide. Those who set up a dog training program, train dogs, or supervise personnel involved in training dogs must be competent in this field.

Animal training is a component of behavioural management and aims to improve the psychological well-being of animals (Bloomsmith et al., 2018). To be effective, training steps should be planned prior to commencing training, and the training approach should be consistent. The patience of personnel during training is essential for progress. For all training, personnel should recognize the emotions the dog is experiencing, which can be determined through observation of behavioural indicators (see Section 8.1, “Welfare Indicators”).

Dogs learn from all human interactions, not only when a person decides to actively train them. In scientific settings, the major objectives of animal training are to reduce or eliminate negative welfare impacts on the animals, increase the efficiency and ease of working with the animals, and decrease the risk of injury to both the animals and personnel as a result of husbandry, veterinary, and scientific procedures. Equally important benefits of training are that it can be a source of enrichment by providing positive cognitive stimulation for the dogs (the process of training itself can be rewarding as they develop cognitive skills), strengthen the relationship between animal care personnel and the dog, and prepare dogs for rehoming. Some forms of training (e.g., positive reinforcement training) can also improve welfare through enabling more control and predictability for the dogs, which may be central to animal welfare (Franks et al., 2012; Spinka and Wemelsfelder, 2011; Bassett and Buchanan-Smith, 2007).

Prior to conducting a scientific activity, time should be allocated to training dogs to any new experiences they will encounter, such as the procedure room, restraint device, and procedures. Training animals requires time and resources; however, time can be saved over the long term by having cooperative animals (e.g., Hall et al., 2015). As an example, leash training that involves giving treats for each small step of accepting the leash and walking calmly, rather than pulling the dog on a leash, allows handlers to move dogs from their home enclosure to the procedure room with ease and can also improve the morale of those working with dogs. As noted in Section 4, “Procurement”, it is beneficial to procure dogs from sources that have established appropriate socialization and training programs.

When training is undertaken to change an undesirable behaviour, recognizing the emotions the dog is experiencing and the current environmental motivators that perpetuate that behaviour (Pfaller-Sadovsky et al., 2019) is the first step. The veterinarian and others, such as an animal behaviour professional, with relevant knowledge and expertise, should be consulted to understand the dog’s behaviour. Then training directed at reducing that behaviour should be commenced, keeping in mind that dogs do not misbehave to establish dominance over people nor engage in purposeful noncompliance. Instead of using punishment to reduce behaviour, care should be taken to teach dogs alternative means of obtaining their desired rewards. A thorough

investigation should first determine the motivation behind an undesirable behaviour, thereby understanding what need the dog is satisfying with their behaviour, and an alternative outlet for the same need should be provided. Additionally, understanding the root cause can reveal environmental management strategies that do not rely on training. For example, if the dog is biting at the leash when being taken out from their kennel to a procedure room, this may indicate a desire for increased human play. Therefore, increasing opportunities for appropriate human play with a tug toy may reduce leash biting, as the dog's needs are satisfied in a different way. Leash biting may also reveal that the dog does not want to be led into a procedure room and is biting the leash to interrupt the walk. Making the procedure room more pleasant by providing high-value food helps ensure that the dog is excited to go in and will likely reduce the dog interrupting the walk.

7.1.1 Training Program

The training program must be based on the advice of those with expertise in dog behaviour and training. Dog trainers and those developing dog training programs should adhere to the following general principles (BC SPCA, 2022) and be aware of individual animal differences through welfare assessments (see Section 8, “Welfare Assessment”):

- Institutions are committed to protecting the welfare of the dogs, and their emotional well-being is prioritized at all times during training sessions.
- Training methods, devices, or tools used on dogs are evidence-based, result in positive welfare, and do not cause pain, injury, anxiety, fear, or distress.
- Trainers and their assistants are qualified in stress-, fear-, and force-free methods, exhibit a high level of professionalism and ethical behaviour, and do not act beyond their professional qualifications.
- For client-owned dogs, trainers ensure clients understand the training methods that will be used.
- Training environments are healthy and safe.

Interactions with dogs should be low-stress and positive, and stress-, fear-, and force-free methods are effective ways to train dogs. Aversive handling and inconsistent handling that is consequently stressful for dogs must be avoided. Methods of training and handling that cause anxiety, fear, panic, frustration, physical discomfort, pain, or any other form of distress must not be used. Research indicates that aversive methods are associated with increased aggression (Casey et al., 2014), and that negative reinforcement methods are associated with increased signs of stress in dogs (Deldalle and Gaunet, 2014). Those working with dogs must be competent in the methods being used and able to recognize welfare indicators (see Section 7.1.2.5, “Qualities of the Trainer”).

Guideline 9

Training methods that are stress-, fear-, and force-free must be used.

Preparing dogs for experiences they will encounter in a scientific environment (e.g., scientific procedures, veterinary exams, and husbandry practices) can eliminate or at least minimize associated negative emotions. The dogs' cooperation is essential for quality data. Where a food reward could interfere with the study results, other forms of positive reinforcement should be used. For example, activities such as ball tossing, human social interaction, or access to conspecifics may act as reinforcers.

As a general principle, the successful training of dogs relies on positive relationships with them. As described in Section 5.6, “Development and Socialization of Puppies”, socialization of puppies is critical to their skill acquisition and welfare. However, socialization programs involving positive interactions with other dogs and people should continue throughout each dog’s life (Prescott et al., 2004). Positive relationships between dogs and personnel should be established through daily positive interaction (Laule, 2010).

There are many different training techniques and learning paradigms in dogs, as summarized by Meunier (2006). Counter-conditioning, systematic desensitization, and positive reinforcement training are preferred approaches, depending on the context, as they reduce the level of fear and stress dogs experience and encourage voluntary cooperation.

Counter-conditioning and systematic desensitization aim to eliminate or decrease an animal’s fear or stress response to a stimulus through a planned process involving small consecutive steps. Also called response substitution, counter-conditioning pairs a reward (see Section 7.1.2.1, “Rewards (Reinforcers)”), such as food, with a mildly aversive stimulus while the dog remains comfortable (Hall et al., 2015; Laule, 2010). However, this will not work if the stimulus is too aversive. In that case, the intensity of the stimulus may gradually be increased in a procedure called systematic desensitization. In combination, counter-conditioning and desensitization are behaviour modification techniques aimed at changing an animal’s emotional state in response to a stimulus, for example, replacing anxiety with pleasure (Meunier, 2006).

Positive reinforcement training involves introducing something positive, such as a food treat, immediately after a desired behaviour occurs. The end result is that the behaviour will increase in frequency. Training using positive reinforcement training is based on stimulus-response-reinforcement. The trainer asks for a behaviour using a signal³, the animal performs the requested behaviour (response), and then the animal gets something they want (reinforcer). The signal can be a spoken word or a hand signal. This form of training can involve the use of a secondary reinforcer, such as a “click”, that is repeatedly paired with the primary reinforcer (e.g., food treat). Through shaping (see Section 7.1.2.2, “Shaping”), dogs are rewarded for completing individual steps, ultimately leading toward the acquisition of the goal behaviour. If a dog does not respond to a command, it means that the initial training was not successful, and those earlier stages of the training must be repeated. It is not helpful to think of dogs as “disobeying” or being “stubborn”.

Positive reinforcement training is a highly preferred form of animal training and can be easily implemented in conjunction with counter-conditioning and systematic desensitization. It works well because it relies on voluntary participation. The dogs engage in learning, try to learn new behaviours, remember what they have learned, develop confidence, and are enthusiastic because they expect the consequences to be pleasurable and the process rewarding.

Habituation is less preferred but can be an important component of training dogs. Habituation simply implies exposure and, while it reduces markers of stress over time, it can be quite stressful early on. Habituation uses repeated or prolonged exposure of a dog to a particular stimulus (Meunier, 2006; Hall et al., 2015; Laule, 2010). While habituation can be effective, in some cases, the animal may exhibit a coping strategy, such as freezing, without a positive physiological change. In such cases, the habituation process does not benefit the animal’s welfare (Laule, 2010; Hall et al., 2015). In addition, some procedures intended to result in habituation, such as sham dosing (applying the procedure without administering a substance), can potentially act as a primer for an aversive response (Hall et al., 2015). It is preferable to have a process that is structured to assist the animal (i.e., counter-conditioning or systematic desensitization) and monitored, rather than relying on a passive process of exposure.

³ A signal is a discriminative stimulus or cue.

An outdated method of teaching new behaviours relies on negative reinforcement and involves removing something aversive when the animal performs the correct behaviour. This is not preferred as it results in fear, resistance, and avoidance behaviour (Hall et al., 2015). An example of negative reinforcement is restraining an animal until it relaxes, then releasing them from the constraint. Another example is a form of “pressure and release” training in which a trainer may hold a dog on a tight leash until it sits, at which point, the leash tension is reduced. From the animal’s perspective, the difference between positive and negative reinforcement is the emotions associated with the behaviour: in positive reinforcement, animals are motivated and happy to perform the behaviour, but in negative reinforcement, animals perform the behaviour to avoid something aversive. In technical terms, “positive” refers to the addition of an appetitive stimulus, and “negative” refers to the removal of an aversive stimulus. Due to the negative consequences on welfare, the use of positive reinforcement techniques is preferred, and negative reinforcement techniques should not be used.

In order to reduce undesirable behaviour, removing the existing reinforcer for the behaviour (i.e., the process of extinction) and teaching an alternative behaviour is effective. For example, to reduce pulling on a leash, the handler may prevent the dog from moving forward by staying still (not allowing the dog to earn the reward of a walk) and also actively teaching the dog to walk next to the handler by rewarding the dog for staying in the correct position.

Training methods based on positive punishment (i.e., introducing something aversive when there is an undesired behaviour) must not be used. Rather than yelling at a dog to make them quiet or jerking on the leash when a dog pulls forward, positive reinforcement training would instead reward the dog for staying quiet or walking close to the handler. Other approaches are useful, such as those described in the following references on decreasing barking in dogs: Zurlinden et al. (2022), Protopopova and Wynne (2015), and Payne and Assemi (2017).

Training methods based on negative punishment (i.e., taking away something the dog wants to reduce the undesired behaviour) should not be used. This method is different from the process of extinction. Whereas a trainer can extinguish jumping up behaviour by simply not rewarding it with attention, negative punishment goes further by imposing an additional contingency, for example, placing the dog into a time-out when they jump. While negative punishment can be effective, it does not address the dog’s needs. Instead, the dog should be taught an alternative behaviour for the same reward, such as sitting to receive attention.

7.1.2 Factors That Affect Training Success

7.1.2.1 Rewards (Reinforcers)

A reward is a stimulus that, when administered after a behaviour, increases the likelihood of that behaviour. This could include food, praise, petting, an enrichment item, or an opportunity for play (Laule, 2010).

Rewards must be chosen carefully, based on the individual dog’s preferences in both the short and long term. Some dogs show a preference for a particular food reward in the short term, while others prefer a variety of food rewards. However, variation in the types of food reward has been found to sustain motivation for training in the long term, even for dogs that initially showed a preference for a single type of reward (Bremhorst et al., 2018).

If a secondary reinforcer is to be used, it should also be chosen carefully. One study involving shelter dogs found that the dogs responded better when a verbal cue was paired with a food reward than when a clicker was paired with the same food (Thorn et al., 2006).

While partial rewarding during clicker training (i.e., not providing a reward after every correct behaviour) has been used to try to increase an animal’s motivation and attention, a recent study that compared continuous rewarding versus rewarding 60% of the time found no difference in learning among dogs (Cimarelli et al., 2020). This study also suggested that dogs who were rewarded 60% of the time exhibited behaviour indicative of a negative affective state, such as frustration; however, this may have been the result of the type of intermittent reward schedule used. Personnel intending to implement a partial reward system should do so slowly and provide justification to the animal care committee for the rate of reduction. An example of a situation where intermittent reinforcement is needed is preparing dogs for activities where they will not always be successful (e.g., tracking endangered species in the wild or alerting to medical conditions with rare occurrences (Gadbois and Reeve, 2014)). If there is no specific need to use partial rewarding, a continuous reward system should be used.

7.1.2.2 Shaping

Shaping is a dog training technique that involves gradually teaching a dog a desired behaviour through a series of small, incremental steps.

7.1.2.3 Individualized Learning

Guideline 10

A flexible training program should be developed for each dog, tailored to individual differences in learning.

The training program should be developed based on the specific animal and the requirements of the scientific activity. Positive reinforcement training is often used for specific scientific, husbandry, or veterinary procedures, or to influence behaviour in other ways.

There are individual differences in how fast animals can learn (Coleman, 2012; McKinley et al., 2003; Gerencsér et al., 2018), and these should be accommodated. For all steps in the training process, the trainer must recognize the various behavioural indicators of the individual dog’s positive and negative emotional states. If a dog shows behavioural indicators of negative welfare, such as fear (see Section 8.1, “Welfare Indicators”), the trainer should return to the previous step in the training program and re-evaluate the approach and conditions.

A challenge for scientific activities occurs when a dog refuses to participate in training. Some dogs do not respond to training or do not enjoy training, and it should be recognized that training can have a negative welfare impact on some dogs.

7.1.2.4 Monitoring and Documentation

Training programs and individual progress should be monitored and documented after each session and regularly reviewed. Dogs’ behaviour should be monitored in their familiar settings. As noted in Section 6.2, “Animal Observation”, increasing the frequency with which personnel are present with dogs can result in more accurate observation of the dog’s normal behaviour.

7.1.2.5 Qualities of the Trainer

Important qualities for trainers and others working with dogs include patience and a calm approach, understanding dogs' needs, recognition of welfare indicators (see Section 8.1, “Welfare Indicators”), and awareness of the importance of the relationship between dogs and people. All personnel involved with a dog undergoing training (i.e., animal care, veterinary, and research personnel) should be trained so that their actions are in line with the training program to ensure consistency (Prescott et al., 2004).

Guideline 11

Personnel conducting training must be competent, with demonstrated expertise in the handling and training of dogs using positive methods, or be under the supervision of someone with such competence.

To ensure animals are trained appropriately and effectively, personnel conducting training must be competent⁴ or supervised by someone who is competent. It is expected that all personnel involved in handling animals are trained in stress-, fear-, and force-free methods. In some cases, it may be appropriate to share dog training between research teams, veterinary personnel, and animal care personnel. Training procedures should be guided by SOPs to maintain consistency while accommodating a team approach.

7.1.3 Training Applications

The following are examples of animal training applications.

Preparing animals for particular procedures:

- using positive reinforcement training to reduce stress associated with procedures such as gavage (Hall et al., 2015)
- using positive reinforcement training involving a clicker and reward to train dogs to remain motionless and attentive for several minutes for eye tracking and non-invasive functional magnetic resonance imaging (fMRI) studies (Karl et al., 2020)

Training animals to move to a particular place:

- using positive reinforcement training and shaping to train animals to move toward a target (target training) (Ferguson and Rosales-Ruiz, 2001); this can be used for weighing dogs, moving them to other areas of a facility, etc.

Applying training to change a behaviour:

- using food rewards and shaping to train dogs to go to a specific place and assume a particular posture when distractions occur that previously elicited problem behaviours (Yin et al., 2008)
- pairing a stimulus, such as a door chime, with a food treat (Pavlovian conditioning) to reduce barking in shelters (Payne and Assemi, 2017)

⁴ For a description of competency, see the [CCAC guidelines on: training of personnel working with animals in science](#) (CCAC, 2015).

- delivering food treats remotely, contingent on periods of dogs not barking, to reduce barking (differential reinforcement of other behaviour) (Protopopova et al., 2016)
- providing a reward on a time-based schedule that is not dependent on the dog's response (noncontingent reinforcement) to reduce “jump-up” behaviour (Pfaller-Sadovsky et al., 2019)
- using positive reinforcement training on dogs within enclosures by providing a treat to reward desirable behaviours (coming to the front of the enclosure, sitting, lying down, and remaining quiet when approached), and moving away from the enclosure when undesirable behaviours occur (Herron et al., 2014)

7.2 USE OF ANXIOLYTIC MEDICATION FOR RESTRAINT

There are several oral drugs that are routinely used in veterinary practice to reduce anxiety and improve restraint success in dogs. In some cases, anxiolytic medication may be an appropriate and less stressful alternative to sedatives or tranquilizers for dogs undergoing stressful procedures (Gilbert-Gregory et al., 2016; Abrams et al., 2020).

In cases where sources of stress cannot be overcome through training alone, anxiolytic medication is a tool that may help to reduce stress and keep the dog comfortable. Dietary supplements may also be helpful, but should not be the primary intervention in cases of moderate to severe fear, anxiety, or stress.

All medication must be evaluated and prescribed by a veterinarian. Anxiolytic medication has been used prophylactically and as a last resort when other options are not successful. In some situations where it is not given prophylactically, stress can increase to a level that makes the medication less effective if given later. An understanding of a drug's pharmacology, a dog's behaviour, and the needs of the scientific activity is key to determining the suitable use of medication. While anxiolytic medication may facilitate learning by reducing stress in dogs (i.e., calmer dogs learn better), there is also the potential for drugs to impair learning.

7.3 PHYSICAL RESTRAINT

Guideline 12

Dogs should be trained to cooperate during procedures to minimize the need to apply physical restraint.

Guideline 13

Restraint techniques must be safe for the dog and personnel while minimizing negative welfare impacts.

The need to restrain a dog and the choice of method must be carefully assessed on a case-by-case basis. The following questions must be evaluated whenever restraint is being considered:

- Is it necessary?
- What is the minimum degree of restraint required?
- What is the shortest duration of restraint required?

- What is the most appropriate technique for this particular situation?
- Is the technique safe for the dog and the handler?
- How can stress be minimized for the dog when using this technique?

The choice of technique will depend on the degree of training relative to the technique that the dog has undergone, the dog's size, and the situation for which restraint is required. In all cases, stress for the dog must be minimized.

When a physical restraint device, such as a muzzle or sling, is required due to the risk of injury to dogs or personnel or for the requirements of the scientific activity, it should be the least restrictive device suited to the situation and should be used for the minimum amount of time necessary.

Restraint should be conducted by personnel competent in executing the particular method. Muzzles that prevent dogs from panting should not be used for extended periods. Dogs should be constantly monitored while being restrained.

Any method, device, or tool that causes a consistent aversive reaction in a dog (e.g., choke collars and electronic collars) must not be used. There is evidence that electronic collars have negative welfare effects and are less effective than positive reinforcement training (China et al., 2020).

Any restraining device must be appropriately sized for the dog.

When dogs are carried, they must be safely restrained, with their body weight supported (Prescott et al., 2004).

Guideline 14

Restraint techniques should be introduced gradually through systematic desensitization and positive reinforcement training.

When restraining techniques are required, dogs should be trained using systematic desensitization and positive reinforcement training to tolerate the form of restraint, especially if it will be performed frequently or for a prolonged period (Prescott et al., 2004). Systematic desensitization and positive reinforcement training will minimize stress for the dog and increase safety for personnel.

WELFARE ASSESSMENT

General guiding principles for welfare assessment of all animals used for scientific purposes are described in the [CCAC guidelines: Animal welfare assessment](#) (CCAC, 2021).

The assessment frequency must enable the detection of any changes in welfare and must be commensurate with the expected welfare impact of the scientific activity. Information gathered in relation to welfare assessments should be recorded in a format accessible to investigators, veterinarians, animal care personnel, and animal care committees.

Information in this section builds on the general guidelines by focusing on indicators for assessing dog welfare, keeping in mind that any indicator must be tailored to the breed and life stage of the dog.

Guideline 15

All dogs used in scientific activities must undergo welfare assessments.

An animal welfare assessment plan should provide information on the emotional state, physical health, behaviour, and physiology of the dog through the collective use of observations and other tools. The welfare assessment plan should be suited to the types of scientific activities and designed to optimize information collection. Welfare assessments should be conducted through regular health assessments, twice-daily observations, information gathered from scientific activities, among other methods, and should not be an additional source of negative welfare for the dog. As noted in the [CCAC guidelines: Animal welfare assessment](#) (CCAC, 2021), information should be obtained through a combination of animal-based measures, resource-based measures, and management-based measures (see Section 8.1, “Welfare Indicators”). While tools are available to measure negative welfare, it is important to combine a variety of indicators.

For client-owned dogs, owners are responsible for decisions regarding their overall welfare. An assessment of the dog’s welfare should be performed during each session of a scientific activity, and the information obtained should be used to determine the dog’s suitability for the scientific activity and to mitigate any welfare concerns during the session. The dog’s owner must be promptly informed of any welfare concerns and must be able to remove their dog from the scientific activity at any time, as noted in Section 4.1.3, “Client-Owned Dogs”.

The welfare of dogs housed in institutions must be assessed throughout their lives. Combining animal-based measures with resource- and management-based measures can help minimize disturbance while obtaining the necessary information to assess the dog’s welfare. Generally, animal-based measures are best for identifying the actual welfare status of individual animals, but they may be less useful for identifying specific causes of poor welfare. Animal-based measures should therefore be assessed and should be prioritized over resource- and management-based measures when evaluating welfare (e.g., if resource-based and management-based measures appear to indicate the dog’s needs are being met but the dog’s behaviour indicates poor welfare, more emphasis should be placed on the behavioural observation).

There is no single, standardized welfare assessment scheme, and the indicators in Section 8.1, “Welfare Indicators”, are intended to be used as examples. The actual welfare assessment will be institution-specific, based on the particular dog, type of scientific activity, and facilities. To identify dogs that require special observation or accommodation, the results of a welfare assessment should be evaluated according to the following categories: acceptable, mild to moderate, severe, and unacceptable (CCAC, 2021).

As part of the welfare assessment plan, it may be useful to prioritize animal-based indicators that measure “high-risk” behaviours with respect to poor animal welfare for use by personnel (technicians, investigators, etc.) when observing the dogs during husbandry tasks or prior to interacting with the dogs.

8.1 WELFARE INDICATORS

8.1.1 Animal-Based Measures

Animal-based indicators are generally considered to be more indicative of an animal’s experience than resource- and management-based measures. They include observation of the animal within their enclosure and during scientific activities (see Section 6.2, “Animal Observation”), and health assessments upon receipt of the animal at the institution (see Section 4.3, “Receiving Animals”) and as part of the animal health program (see Section 9, “Health and Disease Control”). They also include any additional information about the dog’s emotional state, health, behaviour, or physiology that is obtained through the conduct of scientific activities.

Welfare indicators cannot be applied universally without taking into account the individual dogs, their history, their learning experience, and their current situation. Behaviours and coping styles among dogs can be influenced by a number of factors, for example:

- reaction to new environments – there is evidence of a link between laterality (dominance of one side of the brain in controlling activities or functions) and how dogs cope in new environments: dogs with a left-motor bias exhibit behaviours associated with a more negative affective state than dogs with a right-motor bias (Barnard et al., 2018)
- pain response – dogs’ temperaments have been associated with differences in reactions to stress, susceptibility to disease (Corsetti et al., 2018), and behavioural and physiological responses to moderate pain levels (Lush and Ijichi, 2018)
- playfulness – timid (or less bold) dogs may be more hesitant to engage in play behaviour (Svartberg, 2006)

For scientific activities involving client-owned dogs, an owner’s assessment of behavioural welfare indicators may be unreliable (Lush and Ijichi, 2018), unless the owner has been trained to recognize these indicators (Hielm-Björkman et al., 2011).

8.1.1.1 Behavioural Indicators

Behavioural indicators are useful because they help to identify positive and negative emotions and are sensitive to how the animals experience the conditions in which they live. Various behaviours have been associated with good or poor welfare states (see Table 1 and Table 2). Ethograms have been developed to help characterize behaviours; however, “whole animal” indicators, which express overall demeanour, should also be taken into account. Skillful appraisal of animal expressions underlies traditional animal care (Wemelsfelder and Mullan, 2014). Routine documentation of an individual animal’s “normal” behaviours

can help to identify when changes occur, especially in long-term scientific activities or when animals are undergoing procedures or training.

Some behavioural indicators may overlap with health indicators. For example, urination and defecation: the volume of urine and feces is health-related, but urinating and defecating in areas not intended for this purpose may be related to health and behaviour. As well, negative emotional states can exacerbate health issues.

Many behaviours that are considered part of a dog’s normal repertoire can indicate negative welfare states if there is an increase in duration or frequency, or if they are performed in an inappropriate situation. Personnel working with dogs often know the dog’s “normal” behaviour and can assess when they are showing a stress response.

Table 1 Behaviours Associated with Positive Affective States

CATEGORY	EXAMPLES OF BEHAVIOUR	REFERENCES
Affiliative behaviour	Front of kennel, facing forward, wagging tail, play bow, bark, whine, relaxed licking of muzzle of conspecifics	
Typical play behaviour	Toy play, human play, dog play	Held and Spinka, 2011; Ahloy-Dallaire et al., 2018
Behavioural diversity	Full range of species-typical behaviours	
Interested and engaged	Attentive, attracted to stimuli and attempting to approach them, actively focused on a specific object or task, attempts to interact with object	Flint et al., 2023; Arena et al., 2019 cited in Flint et al., 2024
Ability to learn	Performs well with positive reinforcement training or learning behavioural tasks Play after training positively influences learning	Affenzeller, 2020
Ability to cope	Responds calmly and adapts quickly to a variety of novel or unexpected events	Spinka and Wemelsfelder, 2011
Sleep	No deviation from normal sleep patterns for the individual	Bril, 2017; van den Berg, 2017
Positive interactions with people	Exhibits affiliative behaviour (see above); no display of fear	
Body postures and facial expressions	Postures and expressions indicative of a positive emotional state, such as neutral (relaxed) posture, loose movements, bright and alert expression, sweeping tail wags, soft eyes and seeking eye contact, open mouth with loose, relaxed tongue	Hall et al., 2022
Confident	Self-assured, purposeful, unconcerned, composed	Flint et al., 2024

CATEGORY	EXAMPLES OF BEHAVIOUR	REFERENCES
Comfortable	Without worries, settled in their environment, peaceful with external stimuli	Arena et al., 2019, cited in Flint et al., 2024
Relaxed	Easygoing, calm or acting in a calm manner, doesn't show tension	

Table 2 Behaviours Associated with Suspected Poor Welfare States

CATEGORY	EXAMPLES OF BEHAVIOUR	REFERENCES
Stereotypy or repetitive behaviour	Circling, pacing, wall bouncing, tail chasing, self-licking, chewing bars or bedding	Hubrecht et al., 1992; Hetts et al., 1992; Beerda et al., 1999; Mughal, 2002, cited in Stephen and Ledger, 2005; Polgár et al., 2019
Stress and fear behaviours	Panting, barking, paw-lifting, auto-grooming, lip licking, yawning, body-shaking, trembling, cowering	Beerda et al., 1997; Hetts et al., 1992, cited in Stephen and Ledger, 2005; Flint et al., 2024; Polgár et al., 2019
Changes in activity level	Hyperactivity, hypoactivity, listless	Mughal, 2002, cited in Stephen and Ledger, 2005
Vigilance	Increased vigilance, even in the absence of stimulation (e.g., standing or sitting alert)	Hall et al., 2022
Aggression or maladaptive behaviour	Biting, growling, fighting	Willen et al., 2019; RSPCA, 2011
Interactions with people	Fear or withdrawal response toward people, reticence to perform previously normal activities (e.g., not participating in veterinary procedures), increase in escape behaviours or freeze behaviours, standing against a wall	Mughal, 2002, cited in Stephen and Ledger, 2005; Hall et al., 2022
Displacement behaviour	Licking lips or looking away, tail wagging	Firnkes et al., 2017; Pedretti et al., 2023
Change in social interaction with familiar dogs	Reduced attempts for social contact with familiar dogs	Brunt et al., 2023
Appetite	Reduction in normal food consumption	Mughal, 2002, cited in Stephen and Ledger, 2005
Drinking behaviour	Drinking well in excess of normal volume	Overall, 1997, cited in Stephen and Ledger, 2005
Change in behavioural diversity	Increase in passive behaviours, such as lying down, sleeping, or dozing	Gunn and Morton, 1995; Zanella et al., 1996
Coping behaviour	Increased startle, fear or arousal responses to novel or unexpected events	Von Frijtag et al., 2002; Chaloupková et al., 2007; Rennie and Buchanan-Smith, 2006; Polgár et al., 2019

CATEGORY	EXAMPLES OF BEHAVIOUR	REFERENCES
Body postures and facial expressions	Postures and expressions indicative of a negative emotional state, such as hunching, huddling at the back of the enclosure, drooped ears, furrowed brow, darting eyes, dull expression	Hall et al., 2022
Puppy-specific behaviours associated with mild to moderate fear	Lower posture, lower tail, freezing, retreating, flinching, paw lifting, barking, lying on back	Flint et al., 2018
Agitated	Disturbed, upset, hyperactive	Flint et al., 2024
Stressed	Tense, shows signs of distress	Arena et al., 2019, cited in Flint et al., 2024
Tension	Stiff, rigid posture, on edge	Flint et al., 2023
Nervousness	Uneasy, agitated, shows fast arousal, unsettled, restless, hyperactive	Arena et al., 2019, cited in Flint et al., 2024
Sadness	Low arousal, unhappy, downcast, depressed	Flint et al., 2024 (modified from Flint et al., 2023)

8.1.1.2 Observable Health Indicators

Routine health assessments must be conducted by a veterinarian (see Section 9, “Health and Disease Control”). Physical indicators of impaired welfare may include poor body condition; signs of pain, stress, or disease; injuries; and abnormalities of any body system. These indicators may be overt, subtle, or invisible.

If physical health measures indicate impaired welfare, potential sources must be investigated (e.g., housing conditions and group size). The severity and duration of any clinical signs and behavioural changes associated with poor physical health provide information to assess the degree of suffering the dog experiences. Efforts to reduce the impact of any potential negative welfare source should be implemented.

8.1.1.3 Physiological Indicators

It is important to differentiate the physiological stress response (including many endocrine and metabolic processes, such as the sympathetic adrenal-medullary system and the hypothalamic pituitary axis) from a true negative welfare scenario. Koolhaas et al. (2011) describe how the magnitude of the stress response (e.g., an increase in cortisol levels) can be similar for positive and aversive stimuli, so the stress response alone cannot be used to suggest negative affect. Additionally, the return of cortisol levels to baseline levels following a stressful event may be the result of habituation or dysregulation of the hypothalamic pituitary axis system due to chronic stress (Protopopova, 2016). Therefore, positive physiological indicators should be combined with evidence that the experience is truly positive. The absence of negative physiological indicators does not guarantee positive welfare.

Examples of potential physiological indicators that can be useful when considered alongside the behavioural indicators for an animal include:

- cortisol (Chmelíková et al., 2019) – measuring cortisol levels through saliva, blood, or feces may provide insights into a dog’s stress response and overall welfare

- immune function or signs of disease (Righi et al., 2019; Protopopova, 2016) – parameters such as lymphocyte counts and cytokines may indicate how a dog is coping with stress
- body temperature (Travain et al., 2015; Riemer et al., 2016) – a significant increase may indicate stress, whereas a decrease may suggest health issues
- heart rate and heart rate variability (Lush and Ijichi, 2018) – elevated heart rate may suggest either anxiety or excitement

8.1.1.4 Collection of Animal-Based Welfare Data

As noted in Section 3.7, “Personnel”, all those working with or caring for dogs must be trained in using behavioural indicators to assess the dogs’ welfare, and dogs must be observed at least twice daily by trained personnel. In developing welfare assessment procedures, institutions should validate the chosen indicators and assess the potential for variation among observers.

There are a number of resources available that institutions can use to develop procedures for collecting animal-based welfare data. For example, the NC3Rs’ *Housing and Husbandry: Dog – Welfare Assessment* (Hall et al., 2022) section offers information about welfare indicators for dogs and a sample score sheet. Welfare assessments designed for shelters (e.g., Menchetti et al., 2019; Clay et al., 2019) and kennels (e.g., Mugenda, 2019) can also provide useful information as a starting point. Brunt et al. (2023) provide a sample clinical assessment sheet that users are responsible for validating.

As mentioned, identifying behavioural indicators that represent a high risk of negative animal welfare and can be assessed in a short period of time is useful for personnel who only have a short period of contact with the animals during husbandry tasks.

8.1.2 Resource-Based Measures

Resource-based measures evaluate the suitability of the enclosure for the animal being housed (based on general housing standards). Criteria for developing resource-based measures are described in Section 2.2, “Primary Enclosures” (e.g., enclosure size and design), Section 3, “Facility Management and Personnel” (e.g., lighting, temperature, humidity, and noise), and Section 6, “Husbandry” (e.g., group housing requirements, nutrition, and environmental enrichment). Resource-based measures are useful for identifying potential causes of poor welfare.

8.1.3 Management-Based Measures

Management-based measures focus on assessing records (husbandry, medical, mortality and morbidity, scientific procedures, etc.) to identify potential causes of poor welfare. Similar to resource-based measures, management-based factors are useful for identifying potential causes of poor welfare. They are particularly useful in tracking potential causes over time when a change in the dog’s welfare is detected. Dogs can experience cumulative effects from negative experiences (i.e., trigger stacking).

HEALTH AND DISEASE CONTROL

Maintaining healthy animals is important to their welfare and to the quality of the scientific data. Where dogs are not owned by the institution, their owners are responsible for decisions regarding their overall health, including a plan for emergency care. However, when these dogs are involved in scientific activities, an assessment of the dog's health should be performed during the activity. Information that is obtained should be used to determine the suitability of the dog for the scientific activity and to mitigate any health risks to dogs or people during the activity.

Before dogs from the community visit facilities, precautions must be put in place to prevent and control the occurrence of infectious agents. Practices used in veterinary clinics, where animals similarly enter from the community, should be followed as applicable to the situation. For more information, see Stull et al. (2018) and the Canadian Committee on Antibiotic Resistance (CCAR, 2008).

Guideline 16

All dogs should be included in an animal health program.

Dogs residing in an institution should be included in an animal health program; however, such standards cannot be imposed on client-owned dogs and dogs that are in shelters.

A veterinarian must be engaged in the development of the health program, which should be approved by the animal care committee and overseen by people competent in evaluating dogs' health. The animal health program should include:

- prevention of conditions conducive to ill health, with prevention strategies suited to the animals' health status and the intended scientific activities
- health monitoring and detection of latent disease by systematic evaluation of individual animals and the health status of each colony
- an emergency plan for the management of infectious disease in the event of a suspected outbreak

The health program must be tailored to the individual dogs and their life stage. For information on considerations for various life stages, see the American Animal Hospital Association (AAHA, 2019b).

9.1 DISEASE PREVENTION

Guideline 17

Strategic measures for disease prevention should include a program for disease control and a system of regular monitoring and reporting for health assessment purposes.

Animals should be free of unwanted pathogens and clinical diseases, and therefore, a routine and comprehensive health monitoring program is key. Infectious agents may also affect scientific data without causing disease.

A veterinarian must be engaged in developing SOPs to limit the risk of introducing disease into the facility and must be available for consultation on all matters related to animal health. Veterinary care must be available for all dogs at all times on an on-call basis (Prescott et al., 2004).

The disease prevention and control plan should address the following:

- procurement – dogs coming from a supplier should have a recent satisfactory health report provided by the supplier (commercial or non-commercial) and undergo a thorough health assessment at the receiving institution (see Section 4, “Procurement”)
- quarantine – newly arrived animals should be kept separate from other animals in the facility until the veterinarian determines it is safe to integrate them (see Section 4.3, “Receiving Animals”); contagious animals or those suspected to be contagious should be separated from healthy animals; and plans should also be in place to separate infected animals from other animals in the facility in the event of a disease outbreak and should include a disease prevention strategy; in all cases, considerations for the welfare of the animals (e.g., husbandry and housing) must apply to quarantine periods
- facilities and their management – facilities, equipment, and management practices should be in place to prevent airborne, direct contact, or fomite transmission of microorganisms; water contamination; pest infestations; and contaminants from external sources
- husbandry – dogs should be fed a high-quality diet and have suitable housing with regular bedding changes. Practices must be in place for effective sanitation, including testing surfaces and objects, as necessary, to ensure the health of the animals and meet the requirements of the scientific activity. As noted in Section 6.4.1, “Nutrition”, dogs should not be fed raw meat because of the health risks to them and people, such as Salmonella and Campylobacter, which are particularly significant for immune-suppressed animals (CCAR, 2008)
- routine coat care and nail trimming – the need for grooming depends on the breed of dog; grooming can be enriching for some dogs but aversive for others, and steps should be taken to ensure the experience is positive for the dog (see Section 7.1, “Training”)
- oral care – there should be an oral care program that includes preventative care and oral assessments for the prevention of periodontal disease (Wallis and Holcombe, 2020). Dogs should have their teeth brushed daily using a soft-bristled brush (Holmstrom et al., 2013; Harvey et al., 2015) and should be trained to accept the procedure (see Section 7.1, “Training”). When this is not possible or needed (as in short-term scientific activities with dogs that have good oral health), the provision of materials for dogs to chew, particularly dental chews, can help maintain oral health (Holmstrom et al., 2013; Oba et al., 2021; Ruparell et al., 2020); however, they are not as effective as brushing
- biosecurity – biosecurity procedures and health and environmental monitoring must be in place to maintain animals of a particular health status. Criteria should be developed for who can be given access, based on the goals of the scientific activities, the colony’s health, and personnel health. SOPs should detail the use of personal protective equipment and the handling of animals

9.1.1 Immunizations

The vaccination program must be developed in consultation with a veterinarian, taking into account the type of scientific activities the dogs will be involved in and applicable legislative requirements, based on geographical concerns. Useful information for vaccination programs, including timing and core or non-core vaccines, is provided by the American Animal Hospital Association (AAHA, 2022). All dogs should be vaccinated for rabies, distemper, and parvovirus. Adenovirus vaccination is generally beneficial but can cause cross-reactivity with adeno-associated viruses for dogs used in gene therapy. Dogs in colonies may benefit from Bordetella vaccination.

9.2 HEALTH MONITORING AND DISEASE DETECTION

9.2.1 Routine Health Monitoring

Guideline 18

Standard operating procedures must be developed for assessing animal health.

SOPs must be developed for routine health checks for individual animals and for each colony, based on the breed and health status of the animals, the type of scientific activity, and the potential effects on other animals in the facility. Animal monitoring requirements for health and disease control will also depend on the length of time the dogs are housed and the type of facility in which they are housed. These SOPs must be reassessed on a regular schedule, at least every three years, to ensure relevance.

Early recognition of disease onset and progression in a colony is vital. Animal care and research personnel should be able to recognize the common signs of illness.

All facilities must have an SOP that addresses intestinal parasites and the frequency of fecal monitoring, which varies depending on the life stage of the dogs and the risk level of the facility. Intestinal parasite prevention is particularly important for breeding females and puppies. Parasite prevention should also include external parasites (e.g., fleas, ticks, and heartworm), depending on the climate, outdoor access, and location. Information on parasite control is provided by the Companion Animal Parasite Council (CAPC, n.d.).

Animal monitoring procedures must be developed to identify potential health declines as quickly as possible so that a veterinarian can be consulted and a treatment plan put in place. All animals must be observed at least twice daily, as noted in Section 6.2, “Animal Observation”. Procedures must be in place to ensure any animal health concerns or other potential animal welfare issues are documented and communicated to the veterinarian in a timely manner. Good record keeping is also key to establishing and maintaining knowledge of the colony’s health status (Prescott et al., 2004).

The use of antimicrobial drugs in treating infections must take into account both the health benefits to the animals and the challenges posed by the increase in antimicrobial-resistant infections (Morley et al., 2005; Weese et al., 2015).

9.2.2 Physical Exams

A routine physical examination by a veterinarian must be conducted a minimum of once per year and should be conducted twice per year. Examinations must be conducted more frequently for pregnant or lactating females, puppies, and animals at increased risk of declining health, such as aging animals, animals on food and water regulation, and animals in invasive studies or studies that model diseases or other conditions.

The need for routine blood work depends on the age and health of the dogs and the type of scientific activity. Routine blood work is generally not indicated for young, healthy dogs under six years of age, but becomes more relevant for older dogs. Diagnostic testing should be done at various life stages, including puppies, young adults, mature adults, and senior dogs. See the American Animal Hospital Association guidelines for a database of diagnostic tests at various life stages (AAHA, 2019a).

9.3 DISEASE MANAGEMENT IN THE EVENT OF AN OUTBREAK

Guideline 19

A management plan must be in place to deal with unanticipated disease outbreaks.

A management plan must be developed to deal with serious disease outbreaks within the facility and from outside sources, and prevent pathogen transmission and infection recurrence. Plans should include a communication strategy involving veterinarians, veterinary and animal care personnel, protocol authors, the facility manager, and the animal care committee. Access to quarantine facilities or a means of isolating the animals must be available. The Canadian Food Inspection Agency has specific instructions and protocols in place for managing disease outbreaks in dogs, particularly outbreaks of zoonotic diseases.

For infectious disease outbreaks, the veterinarian must be consulted to ensure that the techniques employed will eradicate the pathogens. Typical procedures may include quarantining the room in which the disease is discovered and tracking and testing any animals that were recently moved from that “source” room (Mähler et al., 2014). Follow-up actions will depend on the nature and extent of the outbreak, the animals’ health status, and the type of scientific activity (Mähler et al., 2014). If infected animals are to be humanely killed, proper containment measures must be in place for the handling and disposal of the animals and their bedding, as well as for the decontamination of enclosures and rooms to prevent the spread of disease (Mähler et al., 2014).

In the case of rabies, the veterinarian must be informed of any potential cases. The veterinarian will then determine the appropriate follow-up, which may involve contacting public health officials.

10

SCIENTIFIC PROCEDURES

Guideline 20

The procedure with the least negative welfare impact that is suited to the goals of the scientific activity, based on the body of evidence and available expertise, must be used.

The welfare impacts of procedures are not always known in advance and can be affected by a variety of factors. In determining the potential welfare impacts of procedures, the current literature and available knowledge must be used to assess the impact on the individual dog and other dogs in the room or vicinity, and measures that can be taken to reduce any negative impacts. As techniques advance and new research is conducted, refinements will continue to evolve in many areas, and protocol authors, veterinarians, and animal care committees must regularly evaluate new evidence on refinements and consider their implementation (Smith and Hawkins, 2016).

For routine procedures, SOPs approved by the animal care committee must be available to all personnel involved with the animals to ensure consistency of procedures and animal care. Where new procedures are proposed, SOPs should be developed in consultation with an expert in the subject matter, and input should be sought from stakeholders (i.e., protocol authors, safety officers, and animal care and veterinary personnel) before they are approved and implemented. SOPs must be regularly reviewed and updated as new information becomes available. All procedures must be documented, and records must be kept in electronic files or in close proximity to the housing or procedure areas and be accessible to the veterinary team, the research team, and the animal care committee.

All procedures have the potential to cause negative welfare. Procedures must be performed by competent personnel who have been properly trained by those with appropriate expertise⁵.

“Cumulative endpoints must be considered for all animals held long-term and for animals that have multiple scientific experiences” (CCAC, 2022). Institutions must have a policy or SOP on cumulative endpoints for dogs. The types of procedures and their frequency, the duration of intervals between procedures, and the total number of procedures that may be performed on the same animal during their lifetime must be assessed. The policy or SOP must take into account the welfare impacts associated with those procedures, both short-term and long-term, and the criteria to be used for assessing cumulative endpoints (CCAC, 2022). See Section 12.1, “Transfer of Dogs Between Animal Use Protocols or Facilities”.

⁵ For a description of competency, see the [CCAC guidelines on: training of personnel working with animals in science](#) (CCAC, 2015).

Guideline 21

Scientific endpoints, humane intervention points, and monitoring regimes must be described in an animal use protocol and approved by an animal care committee before any animal-based scientific activity commences. This information should be easily accessible to everyone working with the animals.

For further information on definitions and guidance for establishing and monitoring scientific endpoints, humane intervention points, and cumulative endpoints, see the [CCAC guidelines: Identification of scientific endpoints, humane intervention points, and cumulative endpoints](#) (CCAC, 2022).

10.1 ADMINISTRATION OF SUBSTANCES AND SAMPLE COLLECTION

General principles for the administration of substances and sample collection are outlined in the [CCAC guidelines: Scientific procedures \(Part A – Administration of substances and biological sampling\)](#) (CCAC, 2025a). As noted in this document, “administration of substances and biological sampling procedures should be carried out in a manner that minimizes negative animal welfare impacts on the animal.”

Personnel administering substances to dogs or collecting biological samples from dogs must be competent⁶ in the procedures to be undertaken.

The method for administering substances or collecting biological samples with the least welfare impact should be used, based on the requirements of the scientific activity. Guidance for assessing welfare impact is provided in Section 8.1, “Welfare Indicators”. Factors affecting a procedure’s welfare impact include characteristics of the animal (e.g., size, age, and condition), previous training and experiences, the competence of personnel conducting the procedure, and any requirements for restraint. While some methods, such as ultrasound-guided biopsy, can have less welfare impact than other surgical methods, they may also carry higher risks, and therefore, the technical skills of personnel conducting the procedure must be taken into account. The use of appropriate desensitization and positive reinforcement training (see Section 7.1, “Training”) should be considered to reduce the negative welfare impacts of procedures.

10.1.1 Administration

There are many potential routes of administration, and the selection of the most appropriate route will depend on the scientific activity and whether or not the dog is conscious. The most appropriate route should be determined on a case-by-case basis, based on whether sedation or anesthesia are used and other factors affecting the dog’s welfare.

Voluntary oral administration via mixing the substance with food, hiding it in a treat, or administering it through a syringe in a high-value vehicle substance are preferred methods for studies where the food or treat will not interfere with the substance or other aspects of the study. When the substance is in the form of a tablet or capsule, it can be placed at the back of the dog’s tongue, and swallowing can be induced by massaging

⁶ For a description of competency, see the [CCAC guidelines on: training of personnel working with animals in science](#) (CCAC, 2015).

the dog's throat; however, this is more aversive than voluntary oral administration (MacArthur Clark and Pomeroy, 2010). If fluids are administered orally, they should be given in small amounts to prevent aspiration.

When substances are to be administered by gavage, the tube must be of an appropriate length for the specific dog, proper procedures must be followed to ensure correct placement and to avoid vomiting or regurgitation (MacArthur Clark and Pomeroy, 2010), and the volume administered must be in proportion to the tube length. When sedatives are not used, dogs must be trained or habituated to oral tube placement prior to administration (Hall et al., 2015). If sedation is used, the sedative must be applied carefully to ensure the dog maintains the ability to swallow.

When substances are to be injected, the smallest needle or catheter size should be used, considering the breed and age of the dog, the volume and viscosity of the injection solution, the injection speed, and the injection frequency (CCAC, 2025a; Turner et al., 2011).

The use of inhalation methods requires that the dogs be trained with positive reinforcement in the setting and while wearing the mask used to administer the substance. The time the dog is in the mask with air running through should be gradually increased until it matches the time needed for dosing.

For additional considerations in administering substances, including the selection of appropriate routes and volumes, and proper procedures, see CCAC (2025a), Turner et al. (2011), Diehl et al. (2001), and Taylor (2015). In certain situations, sedation or anxiolytic medication should be considered to make the dog more comfortable.

10.1.2 Sample Collection

Blood can be taken from dogs' cephalic, external jugular, or lateral saphenous veins (MacArthur Clark and Pomeroy, 2010). The preferred method will depend on factors such as the volume required, the sampling frequency, the dog's temperament, and whether the dog has been trained for the procedure.

When repeated blood samples are needed, the benefits and risks of using an indwelling catheter or vascular access port should be analyzed. Factors affecting the benefits and risks include the route from which the sample is collected, the sampling frequency, the length of time over which sampling will take place, and the particular dog. Catheters must be protected with an Elizabethan collar or other appropriate method, and there is the potential for indwelling catheters to fail and require replacement. Procedures must be in place to prevent infection at the catheter site.

Any procedures confining animals beyond the restrictions of regular housing, such as the use of metabolism cages, should only be conducted when there are no alternatives, and they should be used on the fewest number of dogs and for the shortest time possible to meet the scientific objectives. There should be an acclimation period for dogs, and the welfare impacts should be minimized, such as by pair housing (Kendrick et al., 2020), providing a comfortable rest area, and including other requirements of general housing, as appropriate. Systematic desensitization and counter-conditioning (see Section 7.1.1, "Training Program") should also be used.

For additional considerations in collecting samples, including the selection of appropriate routes and volumes, and proper procedures, see CCAC (2025a), Turner et al. (2011), Diehl et al. (2001), and Taylor (2015). In certain situations, sedation or anxiolytic medication can be considered to make dogs more comfortable.

10.2 ANESTHESIA AND ANALGESIA

General principles for anesthesia and analgesia are outlined in the [CCAC guidelines: Scientific procedures \(Part B – Analgesia, anesthesia, and surgery\)](#) (CCAC, 2025b). Anesthesia and analgesia must be applied with adherence to current veterinary practice and guidelines; see CALAM (2020).

A pain management plan must be in place for any procedures that may cause pain. Information on the recognition of pain in dogs and on pain management protocols for common procedures is available in WSAVA's *Guidelines for Recognition, Assessment and Treatment of Pain* (WSAVA, 2014) and *2022 AAHA Pain Management Guidelines for Dogs and Cats* (Gruen et al., 2022).

10.2.1 Anesthesia

Anesthesia is used to chemically restrain an animal and to alleviate pain. For chemical restraint, the aim is to control the animal's movement, not necessarily to alleviate pain, such as for imaging purposes when a dog's movement cannot be sufficiently controlled through training and physical restraint. For surgery and other painful procedures, the aim of anesthesia is to render the animal unconscious and alleviate pain.

Guideline 22

When anesthesia is necessary, an anesthetic plan must be developed in advance and address the following stages: pre-anesthesia, induction, maintenance, and recovery. Monitoring throughout all stages must be part of the anesthetic plan.

Current standard anesthesia protocols should be used. For comprehensive information, see the *2020 AAHA Anesthesia and Monitoring Guidelines for Dogs and Cats* (Grubb et al., 2020). Personnel must monitor dogs throughout anesthesia and respond to physiologic changes to reduce the risk of anesthetic death (Grubb et al., 2020) and prevent complications following anesthesia.

Decisions about the number and frequency of sedations performed on an animal should be made in consultation with the veterinarian and take into consideration the health and welfare of the individual animal. The impact of sedation varies among dogs, and for an individual dog, it will vary with the dose and restraint requirements. Animal-based measures to assess the welfare of dogs undergoing specific procedures, along with appropriate supportive care, must be included in the animal use protocol.

Records must be kept each time an animal is sedated. To minimize the number of sedations, it may be appropriate to conduct some health assessments while animals are sedated for scientific procedures.

10.2.1.1 Pre-Anesthesia

Prior to administering anesthetics for scientific procedures, animals should undergo a thorough health assessment, which may include clinical chemistry and hematology, and an accurate body weight determination. Medication dosage is calculated based on the animal's weight, although some agents may be calculated on the basis of body surface area. An emergency kit should be available, and doses should be pre-calculated to expedite emergency intervention and minimize errors in the event of an emergency.

In the pre-anesthesia phase, water should be provided, but it may be withdrawn in the period preceding the induction of anesthesia to avoid refluxing and aspiration during induction. There are conflicting opinions in the literature regarding fasting. The timeframe for fasting should take into consideration the procedure to be performed and factors related to the health and emotional state of the dog (for examples of potential factors, see the *2020 AAHA Anesthesia and Monitoring Guidelines for Dogs and Cats*; Grubb et al., 2020).

Prior to general anesthesia, dogs should be pre-medicated with a drug combination that provides both sedation and pain control, tailored to the individual animal and the procedure that will be performed. This practice decreases distress, improves the induction process, and decreases the amount of inhalant anesthetic needed. Low-stress handling is an important component of effective anesthesia induction and management.

After pre-anesthetic agent administration, the animal should be monitored and kept in a restricted area to prevent injury. Ideally, the area should be darkened and quiet to improve the medication's efficacy.

10.2.1.2 Induction

When it comes to anesthesia induction, the goal is to make the induction phase as smooth and rapid as possible. Attention must be paid to ensure appropriate pharmaceutical agents are used and anesthetic risks are minimized.

The type and dosage of anesthetic agent must be tailored to the need for restraint or pain mitigation, the objectives of the scientific activity, and the dog's breed and body weight, so that it provides a sufficient anesthetic plane. The minimum dosage required to induce, and subsequently maintain, a sufficient level of sedation or anesthesia to perform the procedure safely should be used. Local anesthetic agent infiltration should be used for minor procedures and combined with general anesthesia during more invasive procedures. The concept of balanced anesthesia is applied to provide a combination of drugs, often at lower doses than if each was used alone, that maintains anesthesia and pain control, as indicated, for a defined period with reduced undesirable side effects.

Injectable anesthesia is usually used alone for short, non-invasive procedures or prior to the use of gaseous anesthesia for smooth and rapid induction and to facilitate intubation. An endotracheal tube is commonly used for maintaining open airways. Preparation and intubation procedures must be determined in advance based on the particular animal.

The use of gaseous anesthetic requires well-maintained equipment with a waste anesthetic gas scavenging system or filter. Procedures must ensure appropriate flow rates are used and that precautions are taken, such as the use of ophthalmic ointment to prevent eye dryness and corneal damage.

The dog's temperature must be monitored, and supplemental heat should be provided, as dogs under anesthesia cannot regulate their body temperature. Supplemental heat is particularly important for small dogs with a high surface area to body mass ratio and for pediatric dogs, as they are less able to thermoregulate than older dogs.

10.2.1.3 Maintenance

Suitable equipment must be available to monitor the animals' vital signs, which must include heart rate, respiration rate, blood pressure, temperature, and O₂ saturation. However, trained personnel must also be present to provide careful observation of the animal's breathing, heartbeat, etc. and to complete monitoring

records. Personnel must be attentive and able to recognize and respond effectively to changes in the animal's physiology to reduce the risk of anesthetic complications or death (Grubb et al., 2020).

The anesthetic depth must be monitored to ensure it is maintained at an appropriate level for the procedure to be undertaken. For surgery, indicators of an appropriate plane of anesthesia include the absence of palpebral reflex, muscle relaxation in the jaw, lack of purposeful movement (Grubb et al., 2020), heart rate, respiratory rate, and blood pressure. Additionally, the dog's eyeball rotates ventrally when anesthetized with isoflurane.

Monitoring anesthetized animals in a magnetic resonance imaging environment requires additional planning. The anesthesia and monitoring equipment must be compatible with the magnetic environment and located at a safe distance to avoid malfunctions and the risk of injury to animals and personnel.

During the maintenance phase of anesthesia, corneal lubricant should be applied at regular intervals to prevent drying.

10.2.1.4 Recovery

During recovery, dogs should be placed in a comfortable recovery area where environmental stress (bright lights and excessive noise) is minimized, and the dogs should be kept warm by providing a supplemental heat source (Grubb et al., 2020).

An anesthetized animal must be monitored continually until they have recovered from anesthesia (i.e., alert, normothermic, and ambulatory) (Grubb et al., 2020). The recovery phase carries a high risk to the animals, particularly during the first three hours, and personnel monitoring the animals must have the same level of training and apply the same attentiveness as required for the anesthesia maintenance phase (Grubb et al., 2020).

Treatment should be provided in accordance with the pain management plan. Pain assessment tools, such as those produced by WSAVA (WSAVA, 2014) and AAHA (Gruen et al., 2022), should be used to inform decisions regarding the correct treatment to manage pain.

10.2.2 Analgesia

Guideline 23

Analgesia should be used for any procedure that would be expected to be painful.

If there is uncertainty regarding whether a procedure may be painful, analgesia should be used. Decisions to withhold analgesia when animals are likely to experience pain must be approved by the animal care committee.

Analgesia should be used pre-emptively for procedures that are expected to cause pain, such as surgery, allowing enough time to reach maximum effect during the maintenance phase of anesthesia and before the onset of painful stimuli. Analgesia should continue to be administered until the expected duration of pain has ceased or as recommenced by the veterinarian. See the *2015 AAHA/AAFP Pain Management Guidelines for Dogs and Cats* (Epstein et al., 2015).

Using a combination of analgesics is often more effective than a single agent. A multimodal approach to pain management should include the use of local anesthesia that is considered safe for dogs, where indicated.

Withdrawal of analgesia should be done slowly, and the animal should be monitored for signs of pain at each dose decrease. Pain assessments should be a component of a dog’s medical and experimental record (see WSAVA (2014) for examples).

When dogs have experienced a painful procedure, they should be monitored and assessed continually by personnel competent in detecting changes in behaviour indicative of pain and distress (see Section 8, “Welfare Assessment”, and WSAVA (2014)) to ensure the pain management plan is effective. Animals that do not appear to be responding to the pain treatment must be reported to the veterinarian. Once the pain management plan is determined to be effective, the time interval between monitoring assessments may be increased.

10.3 SURGERY

General principles for surgery are outlined in the [CCAC guidelines: Scientific procedures \(Part B – Analgesia, anesthesia, and surgery\)](#) (CCAC, 2025b). All surgeries must be conducted in accordance with current veterinary practice and guidelines (see CALAM, 2020). Surgery must not be performed to alter a dog solely for cosmetic purposes (CVMA, 2020).

Major surgeries⁷ must take place in an aseptically prepared surgical suite with an appropriate layout and adequate temperature, ventilation rate, and air pressure differentials (CCAC, 2024a). Minor surgeries, such as wound repair, can be performed in a procedure room.

Preparation of animals for major surgeries should be done in the preparation room of the surgical suite at the time of the procedure. Analgesics should be administered prior to surgery, as noted in Section 10.2.2, “Analgesia”. Prophylactic antibiotic therapy could be used if advised by the veterinarian, in accordance with animal use protocols, to mitigate antimicrobial-resistant infections (Morley et al., 2005; Weese et al., 2015).

Guideline 24

All members of the surgical team must be competent, with demonstrated expertise in their assigned tasks; be informed of the details of the surgery plan in advance; and rigorously adhere to the principle of asepsis to prevent infections.

Training and assessment on the theory and practical aspects of surgical procedures are required to ensure individuals’ competency (see the [CCAC guidelines on: training of personnel working with animals in science](#) (CCAC, 2015)). Members of the surgical team must perform a pre-operative surgical scrub using proper technique and appropriate antiseptic procedures and wear personal protective equipment as described in the [CCAC guidelines: Scientific procedures \(Part B – Analgesia, anesthesia, and surgery\)](#) (CCAC, 2025b). Surgical gloves must be changed between animals or if contaminated during the procedure, and surgical gowns, etc. changed when they are considered non-sterile.

⁷ Major surgeries involve the invasion of a body cavity or involve procedures with the potential for significant complications.

Guideline 25

All surgical procedures must be well planned in advance, taking into account the individual physical characteristics of the dog involved, and include a peri-operative monitoring plan.

Surgeries must be planned and performed in accordance with the following guiding principles:

- they are performed by one or more surgeons with proper training and demonstrated competency
- the least traumatic approach, based on anatomical structures (i.e., the smallest incisions enabling minimal disruption of normal tissues, organs, blood vessels, and nerves), is used
- aseptic technique is used
- appropriate equipment is used
- the most biocompatible material that will promote healing and reduce inflammation, dehiscence, necrosis, or infection is used
- surgical and anesthesia time is the shortest required to achieve the goals through pre-surgery review of the anatomy and surgical approach, and preparation of all the necessary equipment and supplies

The selection, preparation, and sterilization of surgical instruments and safety checks on all equipment (including anesthesia equipment) and monitors must be undertaken in advance of surgery. Grubb et al. (2020) provide a detailed description of all critical equipment and preparations, and the adverse effects on animal welfare if the equipment is not optimal.

The instruments that will be used in surgery must be sterilized by steam or gas, or by immersion in liquid sterilant prior to surgery and between animals. At the time of use, instruments must be innocuous for the tissue (e.g., not too hot to avoid burning and well aerated or rinsed to avoid chemical burns). All required intra-operative medications should be prepared in advance of the surgery (see Section 10.2.1, “Anesthesia”).

As a general practice, those performing surgery should always adhere to Halsted’s surgical principles (Fossum, 2019), as described in the [CCAC guidelines: Scientific procedures \(Part B – Analgesia, anesthesia, and surgery\)](#) (CCAC, 2025b).

If the surgeon is not the veterinarian, the surgeon must be deemed competent and keep up to date with the literature describing advancements in techniques and materials.

The level of invasiveness and the length of the procedure will dictate the necessary precautions and monitoring required.

A competent person must be dedicated to maintaining and monitoring an anesthetized animal; see Section 10.2.1.3, “Maintenance”. Monitoring of these animals could include measuring parameters such as body temperature, mucosa colour, heart rate, respiratory rate, oximetry, end-tidal carbon dioxide, blood pressure, and electrocardiogram, depending on the type of surgery. Hydration and blood pressure should be maintained by intra-operative administration of physiological fluids or other methods. Monitoring should be continuous and recorded for review and later consultation if needed.

10.4 POST-PROCEDURAL MONITORING AND CARE

Guideline 26

Post-procedural monitoring and care must be planned based on the welfare impacts, including the procedure's invasiveness, risk of deterioration in the dog's welfare, and the dog's individual needs, with provisions for unexpected complications.

Facilities should establish SOPs for monitoring dogs after procedures, which include monitoring behaviours indicative of pain (e.g., Epstein et al., 2015). This includes close monitoring of appetite, water intake, and general behaviour at a frequency aligned with the procedure and the dog's condition. The aim is to ensure the dog's pain level is managed.

Proper analgesia should be maintained during the post-procedural period to minimize negative welfare (see Section 10.2, "Anesthesia and Analgesia"). If a dog's pain is not well-controlled, a veterinarian must be consulted to adjust the dose or provide additional treatments. Dogs under anesthesia must be constantly monitored until they recover, as noted in Section 10.2.1.4, "Recovery". After surgery, dogs should also be carefully monitored for cardiopulmonary stability, maintenance of body temperature, and other health indices particular to the procedures performed (e.g., the occurrence of seizures in the case of cranial surgery), and an intervention plan should be in place to address any concerns, such as post-operative pain, delayed recovery, emergence delirium, or dysphoria (Grubb et al., 2020).

The recovery area should be quiet, safe, and comfortable for the dog (as noted in Section 10.2.1.4, "Recovery"). Dogs recovering from anesthesia must not be left unattended, as this is a high-risk period. Non-pharmacological support should also be provided to these dogs to alleviate negative welfare or enhance the effects of a treatment plan. Examples of this support include access to conspecifics, specialized soft bedding, heat support, and positive human interaction, as appropriate.

The need for antibiotics depends on factors such as the type of surgery and the individual dog, and they should be used as advised by the veterinarian, in accordance with mitigating the risks of antimicrobial-resistant infections (Morley et al., 2005; Weese et al., 2015).

Dogs should be returned to their social groups as soon as possible, or at least have visual, olfactory, and auditory contact with conspecifics. The first meal after anesthesia should be approximately half of the regular portion to prevent bloating.

11 HUMANE KILLING

The general guiding principles outlined in the *CCAC guidelines on: euthanasia of animals used in science* (CCAC, 2010)⁸ are applicable to all situations where animals used in science are to be humanely killed. The *CCAC guidelines on: training of personnel working with animals in science* (CCAC, 2015) emphasize the importance of sustaining an institutional culture of respect for animal life, and this should guide the actions of protocol authors, animal care committees, and veterinary and animal care personnel throughout each animal's life, including humane killing. This section provides additional information that is specific to dogs.

The death of animals can have an emotional impact on observers or those performing the procedures, and compassion fatigue is a particular concern when working with companion animals (see Section 13, "Human Safety").

Guideline 27

The humane killing of dogs must be carried out only by competent personnel using the method best suited to the particular animal and the objectives of the scientific activity.

When an animal is to be humanely killed, measures must be taken to make the animal's death as distress-free and painless as possible. Therefore, the method likely to cause the least negative welfare impact to the animal must be selected, consistent with the nature of the scientific activity.

Guideline 28

Sedation should be used prior to humane killing to reduce stress, keep the dog comfortable, and reduce the need for handling and restraint.

For all methods of humane killing performed on dogs:

- Negative welfare caused by handling, and as a result of the method, must be minimized.
- Anxiolytic medication, sedation, or anesthesia should be used prior to humane killing (see Cooney et al., 2012 and Ramsay and Wetzel, 1998).
- Animals must not be mixed with unfamiliar animals prior to being humanely killed.
- Personnel involved in the procedure must be trained and have their competency assessed with regard to the performance of the procedure on the particular animal involved and their ability to confirm death.
- The procedure should be conducted with familiar handlers and in a quiet, familiar environment that is free from other activities, noise, smells, and other animals.

⁸ The term 'euthanasia' is being phased out by the CCAC; 'humane killing' will be used in all new and revised CCAC documents.

- If intravenous injectable methods are used, a catheter should be placed to avoid extravasation.
- Animals must not be left unattended prior to the confirmation of death.
- Equipment must be appropriately maintained and cleaned before reuse.

A dedicated work area should be used for conducting humane killing, which has sufficient space for at least two people to perform the procedures, including handling and restraint, on the types of dogs used at the institution (AVMA, 2020). The area should have appropriate lighting for those working there, dimmable lighting, good ventilation, equipment for handling and restraint, and other necessary equipment, such as a scale, clippers, tourniquets, a stethoscope, cleaning supplies, and a variety of needles and syringes (AVMA, 2020).

11.1 METHODS OF HUMANE KILLING

In addition to the basic requirements for humane killing noted above, the particular method must be evaluated based on compatibility with the species, age, and health status of the animal; time required to induce loss of consciousness; reliability; irreversibility; compatibility with the scientific activity; and safety of personnel (AVMA, 2020).

For dogs, intravenous injection of barbiturates or barbituric acid derivatives should be the method of humane killing (CCAC, 2010; AVMA, 2020). When intravenous access is not possible, intra-organ injection of barbiturates or barbituric acid derivatives in unconscious or anesthetized dogs should be used.

All other methods must be justified to the animal care committee, with measures taken to minimize negative welfare impacts.

Inhalant anesthetics are stressful for dogs, and therefore, an overdose of inhalant anesthetics followed by another method to ensure death should only be used if preceded by a sedative.

Death must be confirmed for all methods of humane killing. For methods other than those mentioned above, plans must be in place for a secondary method (e.g., a second dose or barbiturate for injectable anesthetics) to ensure death. “Only when there is assurance that blood is no longer being delivered to the brain, and respiration and reflex activity have ceased, should the animal be considered dead” (CCAC, 2010). Confirmation of death must involve a combination of criteria, such as “lack of pulse, breathing, corneal reflex, and response to firm toe pinch; inability to hear respiratory sounds and heartbeat by use of a stethoscope; graying of the mucous membranes; and rigor mortis” (AVMA, 2020).

11.2 DISPOSAL OF DEAD ANIMALS

Humanely killed dogs must be disposed of according to the relevant federal, provincial or territorial, and municipal regulations for the disposal of biological materials. The environmental impacts of disposing of dead animals, including impacts on other animals, should be addressed (AVMA, 2020).

12

OUTCOMES FOR ANIMALS AT THE END OF SCIENTIFIC ACTIVITIES

When a dog is to be used in a scientific activity, information on the outcomes for that dog following completion of the activity must be included in the animal use protocol submitted to the animal care committee (CCAC, 2006). The available options will depend on relevant government regulations and factors such as the individual dog's species, age, and history. The animal's outcome must be informed by their current welfare status (CCAC, 2021) and a cumulative endpoints assessment (CCAC, 2022).

12.1 TRANSFER OF DOGS BETWEEN ANIMAL USE PROTOCOLS OR FACILITIES

In line with the Three Rs, the reduction of animal numbers in science may be achieved by assigning animals to other scientific activities when appropriate and approved by the animal care committee. Such decisions must consider the negative welfare experienced during the animal's lifetime (cumulative lifetime experiences). As noted in Section 10, "Scientific Procedures", institutions must have a policy or SOPs on repeated procedures on dogs, which takes into account the number, duration, frequency, and severity of procedures, and their short- and long-term impacts on dogs' welfare (CCAC, 2022). The social acceptance of putting dogs in multiple studies (see Section 1.1, "The Role of Dogs in Society") may also be a factor.

Animals used across multiple animal use protocols (including teaching and training) must have their cumulative lifetime experiences reviewed prior to the approval of each subsequent animal use protocol (CCAC, 2022). Decisions regarding a dog's suitability for a subsequent animal use protocol require serious consideration of the animal's behavioural, physical, and psychological state and the welfare impacts of the additional scientific activity. For general guidance on decision-making for repeated procedures, see the [CCAC guidelines: Identification of scientific endpoints, humane intervention points, and cumulative endpoints](#) (CCAC, 2022). This guidance draws on information acquired through welfare assessments (see Section 8, "Welfare Assessment", and the [CCAC guidelines: Animal welfare assessment](#) (CCAC, 2021)) and determination of the impact of procedures on the welfare of the animals (see the [CCAC guidelines: Categories of welfare impact](#) (CCAC, 2024b)).

Welfare indicators (see Section 8.1, "Welfare Indicators") must be used to determine any changes to the dogs' welfare in response to scientific procedures. Positive socialization and training programs can help reduce the negative welfare impacts experienced by dogs in scientific activities, making it more feasible to transfer them to other animal use protocols. Thus, efforts should be made to use these techniques.

Decisions concerning repeated procedures must focus on the degree of negative welfare experienced by the dog, with consideration of the intensity and duration of the events they are exposed to. For example, some long-duration procedures or conditions of restrictive housing can cause greater negative welfare impacts than short-term procedures that are more invasive.

The source of the dog is a factor in how it responds to being confined in a kennel: dogs that have only known a kennel environment may experience less negative impact from being housed in a research facility than

dogs from other sources (Turcsán et al., 2020). In the case of shelters, the initial fear and anxiety that a dog experiences often subsides with time; however, other negative states, such as frustration and boredom, can increase when the dog's long-term welfare is not addressed (Wells et al., 2002). In terms of housing, the length of stay is only a harm if the dog experiences poor welfare in that environment.

For dogs that are approved by the animal care committee for transfer to another institution at the end of a scientific activity, see Section 4, "Procurement". It is the responsibility of the institution sending a dog to another institution for use in a scientific activity to ensure the receiving institution is CCAC-certified or certified by an equivalent oversight body if it is in another country.

12.2 REHOMING

Guideline 29

Whenever possible, institutions should rehome dogs used in scientific activities with individuals who have the knowledge and ability to provide care that meets those animals' needs.

Rehoming dogs at the end of scientific activities can improve their quality of life, have positive effects on personnel who have been working with the dogs, and address public concerns regarding the outcomes for these animals (Skidmore and Roe, 2020). This can be facilitated through collaboration with organizations that have expertise in rehoming, including the selection and preparation of new owners for their future dogs. Such collaboration should begin well in advance of the release of dogs for rehoming (i.e., when the dogs are acquired) to develop a sustainable relationship.

An agreement between the institution and the organization regarding arrangements with prospective owners can be useful, including provisions for appropriate living conditions and training using reward-based methods. New owners should be made aware of potential challenges and mitigation measures associated with the rehoming process. As with any other animal, if dogs are to be released to the care of an individual as a companion animal, the institution should develop a policy describing the conditions to be met before release of the animal. Institutions should ensure that those adopting the dogs are aware of the care required. Skidmore and Roe (2020) provide an example of a five-stage process for rehoming: choosing the animal, preparing the animal, finding a home, evaluating the owner's capability, and preparing the owner.

It is the institution's responsibility to ensure that rehoming will not compromise the dog's welfare. The suitability of each dog for rehoming should be assessed using validated, robust screening criteria (Stella et al., 2019), and efforts should be made to address any concerns prior to rehoming. For some dogs, fostering may be an appropriate way to assist the transition. It is also important to recognize when rehoming will compromise a dog's welfare and is not a suitable option (Stella et al., 2019).

Rehoming is a process that requires time and resources to prepare the dogs for the transition from the facility to a home and support positive welfare outcomes. As noted in previous sections, measures should be taken while dogs are housed at the institution to facilitate their successful rehoming at the end of the scientific activity. Preparation for rehoming should include house training, preparing dogs to leave the group of dogs they have been housed with and be with various people (e.g., occasionally taking dogs into offices or homes on weekends, and community outreach initiatives, as appropriate), becoming familiar with the outdoors,

learning leash behaviour and basic commands, and becoming familiar with other aspects important to their adjustment to the home environment (e.g., being in a crate, familiarity with stairs, and hearing household noises such as a vacuum cleaner). Dogs should be spayed or neutered prior to rehoming. Dogs should also be prepared for transportation to the new home (Skidmore and Roe, 2020). These and other aspects of preparing dogs for rehoming are described by Hänninen and Norring (2020) and Döring et al. (2017a, b).

13

HUMAN SAFETY

Institutions have occupational health and safety programs that are specifically tasked with addressing this topic through risk assessments.

Those working with dogs must follow institutional policies and SOPs outlining appropriate measures of prevention and protection. People working with dogs should take precautions against bites and scratches, as appropriate. Stress-, fear-, and force-free methods of training can reduce aggressive interactions with dogs (see Section 7.1, “Training”, for details). Personnel working with dogs should also seek professional knowledge on animal allergens, zoonotic diseases, and other risks or hazards that may be associated with a particular scientific activity (e.g., exposure to radiation, anesthetic gas, and chemical hazards).

As noted in Section 6, “Husbandry” and Section 7, “Training and Restraint”, personnel must be competent in their required tasks, as described in the [CCAC guidelines on: training of personnel working with animals in science](#) (CCAC, 2015). Additionally, Section 9.4, “Training and Protection of Personnel” in the [CCAC guidelines: Husbandry of animals in science](#) (CCAC, 2017) provides guidance on personnel training for the well-being and safety of the animals and for the safety of personnel (e.g., good personal hygiene adherence to requirements for personal protective equipment, and awareness of the emotional cost of caring for and working with animals in science).

Investigators and facility managers need to be aware of the emotional cost of caring for and working with research animals. Individuals who are continually subjected to emotionally difficult tasks should be monitored for potentially negative impacts. These individuals may become desensitized as a coping mechanism, which could affect their ability to properly care for and handle the animals. Individuals experiencing emotional difficulty should be offered assistance from their supervisors, and in some cases, tasks/responsibilities should be altered in order to protect people, animals and the quality of research. (CCAC, 2017)

Desensitization could affect personnel’s ability to properly care for and handle the animals, which ultimately negatively impacts dog welfare and data quality. Desensitization can also potentially lead to personnel suffering from post-traumatic stress.

Emotional impact is a complex issue. People working with animals in scientific activities can encounter emotional stress that is unique to that context. In particular, animal care workers have been shown to have unease related to attachment and humane killing, which leads to negative impacts on personnel welfare (Arluke, 1999). Attachment to animals is influenced by the species and the amount of time spent with the animal. Animal care workers report developing the most profound and enduring relationships with dogs, cats, and nonhuman primates in long-term studies, but even fleeting experiences with dogs can result in attachment (Arluke, 1999; Davies and Lewis, 2010). Attachment can result in a conflict between a desire to nurture the animal and the need to conduct the scientific procedure. Some people develop coping mechanisms, such as dissociation or suppression of their feelings; however, these strategies may not be helpful and can result in humane killing becoming routinized. Similar struggles are found in people humanely killing animals in shelters or veterinary clinics (Scotney et al., 2015). Overall, personnel directly engaged in humane killing reported significantly higher levels of work stress and lower levels of job satisfaction, which

may result in higher employee turnover, psychological distress, and other stress-related conditions (Scotney et al., 2015).

Anticipating and managing these stressors as they affect personnel is important for animal-based science (Newsome et al., 2019). For strategies and resources to help manage the emotional burden of working with laboratory animals, see Tremoleda and Kerton (2020), Newsome et al. (2019), and North American 3Rs Collaborative (2024).

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APPENDIX 1

DOG HOUSING AND MANAGEMENT SYSTEM ASSESSMENT TOOL

This tool is intended to assist institutions in: 1) assessing whether their facilities and management practices for holding dogs meet the basic requirements, as described in this guidelines document; and 2) identifying areas for further improvement.

The tool contains elements for assessing housing, divided into Section A, “Physical Aspects of Housing Dogs”, and Section B, “Management Aspects of Housing Dogs”. Both sections must be assessed to address the welfare of the dogs being housed. Each section starts with the elements that must be met. These are followed by elements outlining conditions that should be met to ensure good welfare for the dogs, including those that promote continual improvement in their welfare.

When using this assessment tool, the complete system of physical and management aspects should be assessed, including an evaluation of the relative amount of time that the dogs experience the various elements being assessed. When assessing the elements of a housing system, each element should be evaluated to determine if the dog is using it for the intended purpose, rather than merely documenting that the elements have been provided. For example, a shelf may be present, but it may not be of an appropriate height for the dog to access. Behavioural observations of space use should be conducted, and video recordings may also provide useful data.

The assessment should be a team approach involving the animal care committee, veterinarian, trainer, facility manager, protocol authors and their teams, and animal care personnel. These individuals should have knowledge of the unique characteristics and behaviour of the dogs being assessed (Lambeth et al., 2013).

This assessment tool is generalized and should be adapted to any additional needs of the specific dogs being held, such as those associated with their developmental stage. For example, females need to be able to retreat from puppies, and puppies need areas where they can play as a group and develop species-specific social behaviour.

A. PHYSICAL ASPECTS OF HOUSING DOGS

ELEMENTS THAT MUST BE MET

1. SPACE

ELEMENT	CHECK IF YES
Unimpeded movement for all dogs, without touching the sides or ceiling of the enclosure or other dogs	
Space for each dog to lie down separately from other dogs	
Unimpeded access to food and water for all dogs	

2. SAFETY, SECURITY, AND SANITATION

ELEMENT	CHECK IF YES
Safe for dogs and personnel, including shelter from the elements if dogs are housed outdoors	
Secure perimeter to prevent escapes and intrusions	
Designed to accommodate proper sanitization	

ELEMENTS THAT SHOULD BE MET

1. SPACE FOR A VARIETY OF ACTIVITIES AND BEHAVIOURS THAT ALLOW FOR CHOICE AND CONTROL

1.1 Movement

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Space for dogs to move freely and comfortably, including walking and turning around, and engaging in short bursts of locomotor play	
Preferred conditions	Space for dogs to fully engage in their complete repertoire of movements and locomotor play: sufficient space for dogs to walk, run at full speed, jump, fully extended on their hind legs, and express other normal postural adjustments	

1.2 Sleep

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Separate clean, dry sleeping area that accommodates all dogs, but each dog will be sleeping in the presence of other dogs	
Preferred conditions	Separate clean, dry, and comfortable sleeping area for all dogs that allows each dog to sleep isolated from other dogs, if desired	

1.3 Elimination

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	The area for urination and defecation is separate but not far removed from areas for sleep, play, and eating	
Preferred conditions	Outdoor area for urination and defecation or an indoor area that is far removed from other areas for sleep, play, and eating	

1.4 Retreats for Privacy from Other Dogs or Humans

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Quiet areas where dogs can retreat from other dogs or humans; the number of areas are fewer than the number of dogs	
Preferred conditions	Quiet areas where each dog can completely retreat from other dogs or humans (could be an isolated sleeping area as noted above), and there are at least as many of these areas as the number of dogs	

1.5 Play Areas

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Access to an outdoor or indoor play area with a variety of enrichment options that allow dogs to perform some species-specific behaviours	
Preferred conditions	Access to a high-quality outdoor or indoor play and exercise area with a variety of enrichment options that allow dogs to perform a wide range of species-specific behaviours	

1.6 Flexibility of Enclosures

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Use of permanent enclosures or those with limited adjustability, but with access to multiple room sizes or layouts to accommodate different group sizes	
Preferred conditions	Flexible walls or partitions that can be adjusted easily to meet the evolving needs of individuals or groups of dogs (e.g., size, layout, connections between enclosures)	

2. FURNISHINGS TO PROVIDE COMFORT AND COMPLEXITY

2.1 Bedding

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	A bed of shavings is provided that is removed and replaced as necessary to maintain good hygiene	
Preferred conditions	Each dog has a bed with soft cloth bedding that is replaced and washed as necessary to maintain good hygiene	

2.2 Three-Dimensional Space

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	At least one feature be added that dogs will use to increase their use of three-dimensional space	
Preferred conditions	Optimal use of the three-dimensional space by incorporating platforms and ramps or steps that allow for resting and offer visibility across the room	

2.3 Surfaces (e.g., Grass, Turf, Concrete, Rubber, Sand, Pool of Water)

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Provision of three different surfaces	
Preferred conditions	Provision of five or more different surfaces	

3. DESIGN FEATURES TO LIMIT NOISE

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Some measures to limit noise are incorporated into the room and enclosure design	
Preferred conditions	Rooms and enclosures are designed with robust noise control features that protect dogs from damaging sounds	

4. VISIBILITY

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Dogs have some visibility outside of their enclosure, and personnel can observe the dogs with little disruption to them	
Preferred conditions	Dogs have excellent visibility of their surroundings outside of their enclosure, and personnel can easily observe the dogs without significantly disrupting them	

5. ACCESS TO DOGS BY PERSONNEL

5.1 Ease of Access

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Minor challenges for facility and research personnel to access and interact with the dogs	
Preferred conditions	No challenges for facility and research personnel to access and positively interact with the dogs	

5.2 Specialized Areas for Interactions and Management

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Provision of areas that allow some separation of dogs for particular purposes	
Preferred conditions	Provision of areas that allow separation of dogs for treatments, feeding, positive reinforcement training, and the introduction of new animals to a pair or group	

B. MANAGEMENT ASPECTS OF HOUSING DOGS

ELEMENTS THAT MUST BE MET

ELEMENT	DESCRIPTION	CHECK IF YES
Standard operating procedures (SOPs)	SOPs are in place to ensure dog care is consistent within the institution	
Contact with other dogs	Dogs have the option for visual, olfactory, and auditory contact with other dogs when in their enclosure	
Personnel competence	Trained personnel who can recognize behavioural, physical, and psychological signs of positive and negative dog welfare observe the dogs twice daily	
Environmental enrichment	An effective environmental enrichment program is in place	

ELEMENTS THAT SHOULD BE MET

1. BEHAVIOURAL OPPORTUNITIES THAT PROMOTE POSITIVE WELFARE

1.1 Social Housing

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Compatible pair housing with opportunity for daily affiliative social interactions, or single housing with opportunity for daily affiliative social interactions	
Preferred conditions	Opportunity for positive social contact with other dogs and people through compatible pair or group housing, with additional opportunities for social interaction outside of the primary enclosure	

1.2 Avoidance of Agonistic Behaviours

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Mild to moderate agonistic interactions are occasionally observed	
Preferred conditions	Opportunity for dogs to escape from agonistic interactions that result in a negative impact on welfare; agonistic interactions are rarely observed	

1.3 Stable Social Structure

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Group structure remains mostly stable for all dogs, except in the occasional case where conflict arises that cannot be mitigated	
Preferred conditions	Group structure remains completely stable for all dogs, and in the rare case where conflict arises, it can be mitigated	

1.4 Environmental Enrichment Program

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Environmental enrichment program incorporates multiple types of stimuli (at a minimum, chewing objects and foraging opportunities appropriate for the dogs), uses novelty, and engages most dogs	
Preferred conditions	Environmental enrichment program incorporates physical, social, cognitive, and sensory (visual, tactile) stimuli, maximizes novelty, and engages all dogs	

1.5 Cognitive Enrichment

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Positive reinforcement training, systematic desensitization, and counter-conditioning are incorporated into some aspects of dog care	
Preferred conditions	Positive reinforcement training is incorporated into husbandry, veterinary, and scientific procedures	

2. NOISE REDUCTION MEASURES

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Management measures are in place that result in only occasional barking or other loud noises that require hearing protection ¹ , but hearing protection is not part of the daily routine	
Preferred conditions	Management measures have been taken to reduce noise such that hearing protection for barking is not required, and other loud noises are extremely rare	

¹ It is difficult to measure the effects of noise on dogs, so human safety can provide a comparative approach.

3. PREPARATION FOR REHOMING

CONDITIONS	DESCRIPTION	CHECK IF YES
Acceptable conditions	Dogs receive exposure to some features and experiences of a home environment	
Preferred conditions	Dogs receive exposure to most features and experiences of a home environment, including house training	

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