



# Stress in owned cats: behavioural changes and welfare implications

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## Abstract

Domestic cats are exposed to a variety of stressful stimuli, which may have a negative effect on the cats' welfare and trigger a number of behavioural changes. Some of the stressors most commonly encountered by cats include changes in environment, inter-cat conflict, a poor human–cat relationship and the cat's inability to perform highly motivated behaviour patterns. Stress is very likely to reduce feed intake, and stress-related anorexia may contribute to the development of potentially serious medical conditions. Stress also increases the risk of cats showing urine marking and some forms of aggression, including redirected aggression. A number of compulsive disorders such as over-grooming may also develop as a consequence of stressful environments. Some of the main strategies to prevent or reduce stress-related behavioural problems in cats are environmental enrichment, appropriate management techniques to introduce unfamiliar cats to each other and the use of the synthetic analogue of the feline facial pheromone. As the stress response in cats depends, to a large extent, on the temperament of the animal, breeding and husbandry strategies that contribute to the cat developing a well-balanced temperament are also very useful.

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## Introduction

The term 'stress' has been widely used in biology to describe a set of physiological and behavioural changes elicited by noxious or unpleasant stimuli,<sup>1</sup> with the hypothalamic–pituitary–adrenal (HPA) axis and the sympathoadrenomedullary system being generally considered the two main elements of the stress response.<sup>2–4</sup>

There is now sufficient evidence to show that it is not the physical nature of an aversive stimulus that has negative consequences on the animal but rather the degree to which the stimulus can be predicted and controlled.<sup>5,6</sup> As a result, it has been suggested that the term 'stress' should be restricted to conditions where an environmental demand exceeds the regulatory capacity of the organism, in particular when such conditions include unpredictability and uncontrollability. In domestic animals, stressors can be conveniently divided into physical stressors, social stressors resulting from the interactions with individuals of the same species and stressors related to handling by humans. According to its duration, stress is classified as acute or chronic.<sup>1</sup> Stressors have additive effects, which means that when several stressors impinge upon the animal at the same time, the resulting stress response will be much higher than if the animal was exposed to one stressor only.<sup>7</sup>

Stress in companion animals is important for several reasons. Firstly, when it is intense or long lasting enough to overtax the adaptation capacity of the animal, stress has a negative effect on the welfare of the individual.<sup>8,9</sup> Secondly, behavioural changes associated with stress can be especially annoying for owners and, as a consequence, stress-related problems are a very common cause of relinquishment and euthanasia of dogs and cats.<sup>10–12</sup> Additionally, it is obvious that in these cases the human–animal bond may be negatively affected. Finally, there is growing evidence to support the relationship between stress and disease, which will be discussed in this review.<sup>6,13</sup>

Several behavioural changes in cats, such as some elimination problems, aggressive behaviours or compulsive behaviours, are related to stress.<sup>11</sup> In this review we will address the behavioural changes related to stress

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that are the most commonly seen in veterinary practice. Additionally, we will discuss the effect of stress on the health of the cat, as well as the main treatment and preventive measures.

## Temperament and stress

The stress response of a given cat will depend not only on the environment in which the cat lives, but also on the individual's temperament. Temperament has been defined as individual differences in behaviour that are stable across time and across situations, and which are mainly related to the animal's reaction to a challenge.<sup>14,15</sup>

A cat's temperament depends on its genetic make-up and its early experience. The effects of the cat genotype on its temperament have been revealed through studies looking at the effect of paternal temperament, breed and coat colour. It has been shown, for example, that kittens with friendly sires are friendlier towards humans (both familiar and unfamiliar) than kittens with unfriendly sires.<sup>14,16,17</sup>

As for the breed effect, some authors have concluded that Persian and Siamese cats are more interactive (more playful, curious and friendly) than non-pedigree cats,<sup>18</sup> while others have highlighted that Bengal cats score highest in aggression towards owners and Persians score lowest in activity level.<sup>19</sup> Furthermore in cats, associations between coat color and temperament have been found. Some studies have found that orange cats are more aggressive and darker cats more sociable than cats with other coat colours.<sup>20</sup> Other studies, however, have failed to obtain similar results.<sup>21,22</sup>

The effects of early experience on temperament have been described in several papers. For example, it has been reported that kittens reared by an experienced dam and weaned at a late age develop fewer behaviour problems (including lack of bite control and frustration-related aggression) than kittens weaned too early or reared by an inexperienced dam.<sup>23</sup> Furthermore, kittens born to undernourished dams that usually show poor maternal behaviour are likely to develop behavioural abnormalities.<sup>24</sup>

The socialisation period in cats begins at the age of 2 weeks, when cats are able to interact with their environment, and finishes at around 7 weeks of age. The kittens' experiences during this period will have long-lasting effects on their development and behaviour.<sup>24-27</sup> For example, kittens handled during this period are friendlier towards humans than non-handled kittens. Both the amount of handling and the number of handlers have an effect on the degree of friendliness towards humans.<sup>14,27,28</sup> One aspect that is related to the socialisation process and that may influence the cat's temperament is its origin. In fact, studies performed in dogs and cats suggest that animals from pet shops have a higher probability of developing behavioural problems than animals from other

sources. Although the reasons for this difference are not clearly understood, it has been suggested that kittens reared in pet shops may not be exposed to many stimuli during the sensitive period.<sup>29,30</sup>

## Causes of stress

Some of the main causes of stress in cats include environmental changes, a barren environment, a poor human-cat relationship, inter-cat conflict, and lack of control and predictability.

Novelty may be stressful in itself and therefore changes in the physical environment of the cat, as well as the arrival of a new household member or a change in the daily routine, may all lead to stress.<sup>31,32</sup>

A barren environment that provides few opportunities to express normal behaviour may also lead to stress,<sup>33</sup> and promoting the cat's natural behaviour using enrichment strategies has been shown to reduce it.<sup>8,34-37</sup> There are some species-specific behaviours that seem to be particularly relevant from an animal welfare standpoint,<sup>38</sup> and enrichment strategies should mainly target such behaviours. For instance, outdoor cats spend a high proportion of their active time hunting and exploring their territory, and the inability to engage in such behaviours when cats are kept indoors (particularly in a barren environment) may result in stress-related problems.<sup>39</sup> Scratching is also a feline behaviour. It serves several functions as it has an important role in territorial communication and helps to maintain claw health.<sup>40</sup>

A poor human-cat relationship is another important cause of stress. In most cases, a poor human-cat relationship is a consequence of either inappropriate socialisation or inadequate handling, such as using punishment. Owners with a lack of knowledge about cat behaviour may contribute to these problems.<sup>41,42</sup>

Inter-cat conflict may appear as a result of several causes, including the introduction of a new cat or the reintroduction of a cat that was previously separated owing to a medical problem or other circumstances.<sup>43-45</sup> In both cases, a territorial conflict or a defensive aggression (probably owing to the different odour of the cat) could occur.<sup>46,47</sup> Competition for resources, such as resting places or feed bowls, may also lead to inter-cat conflict, and territorial cats tend to block access to valuable resources. In fact, on some occasions, elimination problems are a consequence of a territorial conflict as the territorial cat does not allow the other cat to access the litter box.<sup>48</sup>

One of the main psychological factors that increase the aversive dimension of a given stimulus is a perceived sense of unpredictability and lack of control.<sup>34,49-52</sup> In the domestic environment, both changes in the husbandry routine and inconsistency in the owners' reaction to the cat behaviour may cause chronic stress.

**Table 1** Main behavioural changes caused by stress (adapted from Rochlitz<sup>70</sup> and Amat et al<sup>27</sup>)

Behaviour	Changes caused by stress
Feed intake	Usually decreases but may increase in some circumstances
Grooming	Usually increases but may decrease in some circumstances
General activity	Decreases
Play	Decreases
Exploratory behaviour	Decreases
Facial marking	Decreases
Positive interactions with other cats and with humans	Decrease
Vocalisation	Increases
Vigilance	Increases
Hiding	Increases
Urine spraying	Increases
Aggressive behaviour	Increases, particularly redirected aggression and some forms of affective aggression
Compulsive behaviours	Increase (compulsive behaviours will not develop in healthy cats in an optimal environment)

## Stress and disease

One of the consequences of the stress response is suppression of the immune system function and the development of a new infection or the reactivation of a previous one.<sup>53</sup> For instance, it seems that stress has an important role in the reactivation of feline herpesvirus: this is a common cause of respiratory disease in cats and a frequent problem in, for example, cat colonies.<sup>54–56</sup> According to Tanaka et al,<sup>56</sup> cats with high levels of stress are almost five times more prone to develop upper respiratory tract infection than cats with lower levels of stress.

Stress has been associated with several gastrointestinal problems such as diarrhoea or vomiting.<sup>57,58</sup> It seems that stress can alter the integrity of the intestinal barrier,<sup>59</sup> which will, in turn, cause an increase in its permeability and a local inflammatory reaction.

Stress has an important role in the development of feline interstitial cystitis (FIC), which is the most common diagnosis in cats with feline lower urinary tract disease.<sup>60,61</sup> Although the precise mechanism by which stress contributes to FIC is not clearly understood, it seems that the glycosaminoglycan layer of the urine bladder wall is thinner in cats with FIC than in healthy cats, and there is an increased activation of the sympathetic nervous system that causes altered bladder permeability.<sup>62</sup> Cats with this recurrent disease may show dysuria and haematuria, and very often urinate outside the litter box.<sup>61,63</sup>

Furthermore, there is a clear connection between skin and nervous system.<sup>64</sup> Some dermatological diseases, such as atopic dermatitis or acral lick dermatitis, can be affected by stress, which is likely to trigger or perpetuate pruritus.<sup>65–67</sup> For instance, a negative correlation has been found in atopic patients between stress-coping

skills and levels of immunoglobulin E (IgE); high levels of IgE may contribute to allergic diseases.<sup>68,69</sup>

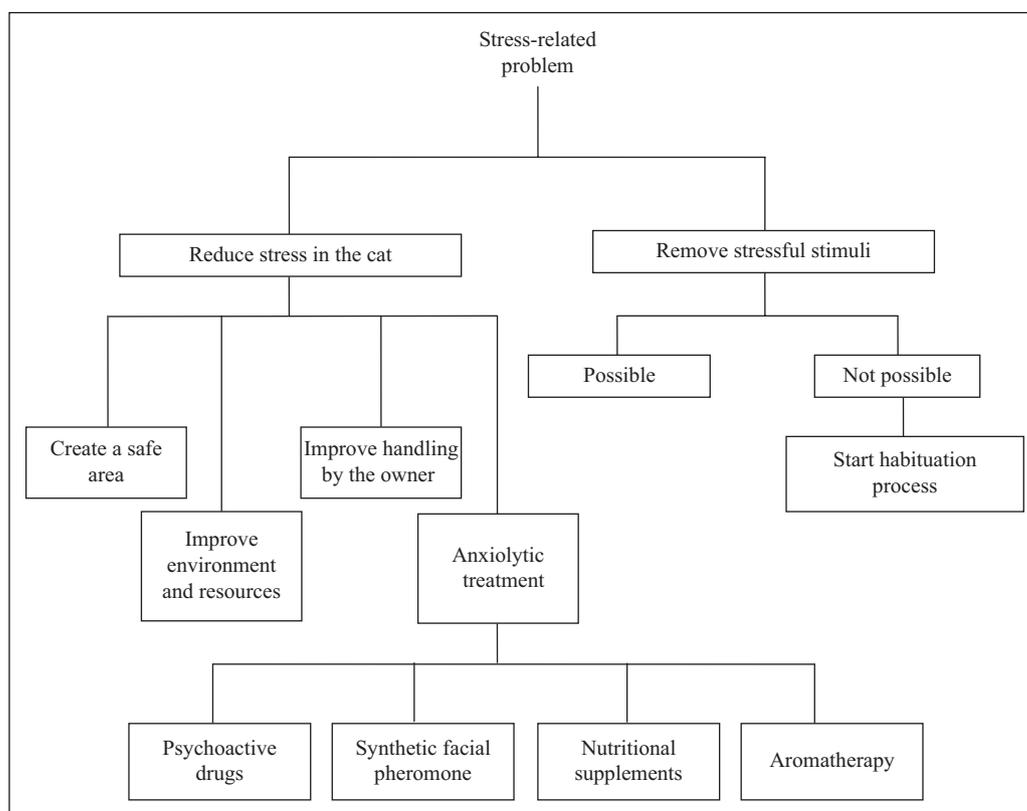
## Behavioural changes caused by stress

Stress may cause a wide range of behavioural changes in cats (Table 1). In some cases, stress inhibits normal behaviour,<sup>32</sup> and cats will hide for long periods of time, play less, reduce their exploratory behaviour and show fewer affiliative behaviours such as allorubbing or allogrooming.<sup>70</sup> In these cases, owners may not be aware of the discomfort being experienced by their cat.

One of the most serious stress-related behavioural changes in cats is anorexia, which may lead to potentially fatal as hepatic lipidosis. Hepatic lipidosis seems to be particularly common in overweight cats that stop eating because of a stress response.<sup>71</sup> Stress-induced anorexia is mediated mainly by the release of corticotropin releasing hormone (CRH) from the hypothalamus. CRH influences the hypothalamic circuitry controlling appetite and food intake, and modulates the oculomotor pathways involved in the recognition and acquisition of food.<sup>72</sup>

Additionally, stress seems to increase food neophobia,<sup>73</sup> and therefore stress-induced anorexia is likely to be more pronounced when cats are given a new food in a stressful environment.

In some cases, however, stress may cause polyphagia.<sup>74–76</sup> Indeed, the effect of stress on feed intake results from the complex interplay between a vast array of hormones and neurotransmitters, including glucocorticoids, leptin, insulin, CRH, urocortins, neuropeptide Y and melanocortin, among many others.<sup>74,77–79</sup> The precise effect of the stress on food intake will depend on several factors, including the intensity of the stressor.<sup>75</sup>



**Figure 1** Strategies to prevent and reduce stress in cats

As a consequence of stress, cats may also exhibit compulsive behaviours.<sup>66,80,81</sup> Compulsive behaviours are repetitive behaviours that may arise as a consequence of a disease or when the animal is not able to adapt to the environment.<sup>82</sup> Compulsive behaviours may serve as a coping mechanism when animals are exposed to stressful events. Indeed, several studies have shown a decrease in plasma glucocorticoid concentration in sows, calves and pigs with compulsive behaviours.<sup>83–85</sup> As several medical conditions can cause these disorders, the first step in the diagnosis is to rule out such conditions by carrying out a physical and neurological examination, a complete blood cell count, biochemistry profile and urinalysis.<sup>81</sup>

Three of the most common compulsive disorders in cats are the condition known as feline hyperaesthesia syndrome (FHS), psychogenic alopecia and pica. Cats with FHS show brief bursts of unusual behaviour such as a rolling skin, intense grooming, scratching and running. Others signs are salivation, vocalisation and uncontrolled urination.<sup>86</sup> FHS is more common in mature cats. Although its causes are not clearly understood, it has been suggested that both epileptic seizures and myopathies may be involved.<sup>87,88</sup> Nevertheless, FHS could be the consequence of any situation related to stress, conflict or frustration, and has also been linked to barren environments.<sup>86</sup>

Overgrooming disorders such as psychogenic alopecia seem to be more common in Siamese and Abyssinian cats.<sup>89,90</sup> Usually, alopecic areas are located in the caudal part of the body, mainly on the ventral abdomen.<sup>80,86</sup> Sometimes this behaviour is related to FIC, as the affected animals lick their abdomen in order to alleviate pain.<sup>80</sup>

According to the literature, pica (eg, eating of non-food items) can be considered either a compulsive disorder or a feeding disorder.<sup>91–93</sup> Pica in cats may involve various materials such as wool, cotton, fabric, rubber or plastic.<sup>66,94</sup> Some authors have suggested that pica could be a coping mechanism,<sup>95,96</sup> and it may also have a genetic component, as Oriental breeds show this disorder more frequently.<sup>94</sup> Additionally, it is believed that stressful events play an important role in the development of pica.<sup>94</sup>

Stress can also affect urine marking behaviour: this is a normal behaviour seen most frequently in intact males and in females in oestrus.<sup>97,98</sup> Oftentimes, but not always, cats mark by spraying urine on vertical surfaces. Stress increases the frequency of urine marking and, in particular, cat density and the likelihood of inter-cat conflict seem to have a major effect on the frequency of this behaviour, which has an incidence of 25% in single-cat households and up to 100% in households with 10 or more cats.<sup>99</sup>

The relationship between stress and aggression is bidirectional: offensive and defensive aggressions cause

a stress,<sup>100,101</sup> and the activation of the HPA axis facilitates aggressive behaviour.<sup>102</sup> Redirected aggression is a fairly common type of aggression in cats and consists of the animal attacking a stimulus other than the one that elicited the aggressive motivation.<sup>102,103</sup> Redirected aggression may serve as a coping mechanism when cats are exposed to stressful events, and some studies have observed that plasma glucocorticoid concentrations decreased after redirected attacks.<sup>104–106</sup> Additionally, most instances of redirected aggression in cats involve a defensive posture,<sup>102</sup> which adds further support to the possible link between fear (and more generally stress) and this form of aggression.<sup>107,108</sup>

### Strategies to prevent and reduce stress in cats

Whenever possible, the stressful stimulus should be removed. However, this is not always possible; for example, when the stressful stimulus is the other cat that lives in the same household. In these cases, exposing the cat to the stressful stimulus in a pleasant context and in a gradual manner may be very useful to progressively reduce the cat's response (see Figure 1).<sup>109,110</sup>

In cases of inter-cat conflict, for example, a reintroduction protocol could be used.<sup>111,112</sup> The protocol is divided into three phases: olfactory habituation, visual habituation and direct contact habituation. The duration of each part is variable, depending on the severity of the conflict, the cats' response and the owner disposition. In the olfactory habituation phase, each cat is confined to a different part of the household and all important resources (including food, water, litter box and scratching post) are provided in both areas. Each cat is then moved to the other area so that both animals are exposed to the other cat's odour. Additionally, using a piece of cloth, the secretion of the facial gland of each cat can be applied to the cheeks of the other cat. The visual habituation phase can start when both cats are relaxed during territory exchanges. In the visual habituation phase, visual contact between cats through a mesh door, for instance, is provided when cats are engaged in a pleasant activity. Cats are otherwise kept separated and the duration of the visual contact sessions is gradually increased. Finally, in the last phase of the reintroduction protocol (direct contact habituation), the wire mesh is removed.

Environmental enrichment is a technique used to reduce stress and improve welfare by increasing the physical, social and temporal complexity of the environment.<sup>33</sup> It is not a static change, so should change over time. Nevertheless, it is important to remember that sudden changes can cause additional stress and therefore all changes should be made in a very progressive way. The main features of an environmental enrichment programme for cats include the following:

- Provision of a safe area where the cat feels comfortable and has all the important resources.<sup>113</sup> Potential stressors such as other cats or dogs should be prevented from entering the safe area.
- As cats spend a high percentage of time foraging, providing puzzle feeders and hiding food in several places may be very useful.<sup>113,114</sup> Mainly in indoor cats, toys should be used and changed at regular intervals to keep the cat's interest.<sup>115</sup> Toys that simulate small, moving catchable prey are particularly useful.<sup>116,117</sup>
- Providing a vertical or a three-dimensional space (eg, shelves, cat trees or platforms) should be encouraged, as cats use vertical space as a vantage point and as a hiding area.<sup>29,113,118,119</sup> In fact, some studies have suggested that providing hiding places reduces stress.<sup>34,120,121</sup>
- The litter tray, the resting area and the feed bowl should be kept separate.<sup>33</sup>
- There is some evidence to suggest that cats are strongly motivated to scratch; therefore, providing a suitable substrate for scratching is an important enrichment strategy.<sup>122</sup>

In multi-cat households, an adequate distribution of resources to avoid conflict is essential, and this should include the feed and water bowls, resting areas and litter trays.<sup>123</sup> This is even more important when one cat tries to prevent the other cats from accessing a particular resource.<sup>113,122</sup> The number of litter boxes will depend on the number of cats, and there should be at least the same number of litter boxes as cats that live in the house, and they should be located in different locations and be easily accessible (particularly when there are geriatric cats).<sup>113,124</sup>

Although restricted feeding could sometimes be recommended (particularly in obese cats), it may cause stress; therefore, ad libitum feeding is probably better on welfare grounds associated with other practices to reduce obesity (eg, measures to increase activity, such as periods of play).<sup>125</sup> Particularly when FIC is suspected, it is also very important to encourage cats to drink enough water in order to dilute the urine.<sup>126–128</sup> Both water fountains and water bowls that are big enough so that the cat's vibrissae do not touch the sides of the bowl are potentially useful.<sup>122</sup>

As we have highlighted that stress and temperament are related, it is very important that during the sensitive period kittens have contact with all the stimuli they are likely to encounter later on in life; otherwise, they are likely to react with either a negative emotional state such as fear or an inappropriate behaviour such as aggression.<sup>43,129</sup> These interactions between the cat and the stimuli should be positive; otherwise, the negative response of the cat towards them will increase.

Punishment by owners should be completely avoided.<sup>130,131</sup> Daily routines (eg, play time, feed

schedule, owner schedule) and interactions with the owners should be predictable, thus reducing the chronic stress associated with unpredictability.<sup>113</sup> Further, cats should always have control of their surroundings, which is particularly important in cats experiencing stress. This can be achieved by providing them with safe areas as previously described.<sup>113,130,132–135</sup>

A discussion of the pharmacological strategies that can be used to treat stress-related problems is beyond the scope of this review. However, it is important to note that administering a drug may be an additional source of stress. Therefore, one important aspect to be considered is the frequency of drug administration. For example, in cases of stress-induced anorexia, benzodiazepines have been widely recommended as appetite stimulants in cats.<sup>136</sup> However, some of them, particularly diazepam, can cause hepatic necrosis, even after a short treatment.<sup>137–139</sup> A safer option is mirtazapine, a tetracyclic antidepressant with noradrenergic and serotonergic activity, which has been used in cats with chronic kidney disease owing to its antiemetic and appetite stimulant properties.<sup>140,141</sup> One of the advantages of this drug is its fast onset of action and its dosage, as it has to be administered every 3 days.<sup>141</sup>

A potentially very useful treatment and prevention strategy for stress-related problems is the synthetic analogue of the feline facial pheromone (Feliway; Ceva Animal Health). This pheromone has been shown to facilitate cats' habituation to new environments and is therefore useful in hospitalised cats, and when cats are transported or moved to a new home. The pheromone also reduces non-sexual urine spraying and compulsive disorders.<sup>142–146</sup> Depending on the situation, Feliway can be used as a spray or as a diffuser, and can be combined with other anxiolytic products.

Recently, both nutritional supplements and aromatherapy have gained popularity in treating or preventing stress-related problems. Although more research is clearly needed in this area, there is some evidence to show that alpha-casozepine, which is a gamma-aminobutyric acid agonist, reduces anxiety in number of species, including the domestic cat.<sup>147–149</sup> As for aromatherapy, it seems that lavender essential oil has calming effects in cats.<sup>150</sup>

## Conclusions

Stress-related problems such as behavioural changes and some diseases have a strong negative impact on cat welfare. The main causes of stress include a barren or unpredictable environment, as well as conflicts with other cats. Strategies to reduce or prevent stress should aim at improving the environment of the cat or reduce inter-cat conflict.

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## References

- Moberg GP and Mench JA. The biology of animal stress. Basic principles and implications for animal welfare. Wallingford: CABI Publishing, 2000.
- Cannon WB. The wisdom of the body. New York: WW Norton, 1932.
- Mason JW. **A review of psychoendocrine research on the pituitary–adrenal–cortical system.** *Psychosom Med* 1968; 30: 576–607.
- Selye H. The stress of life. New York: McGraw-Hill, 1956.
- Beerda B, Schilder MBH, van Hooff JARAM, et al. **Behavioural, saliva cortisol and heart rate responses to different types of stimuli in dogs.** *Appl Anim Behav Sci* 1998; 58: 365–381.
- Weiss JM. **Influence of psychological variables on stress-induced pathology.** In: Porter R and Knight J (eds). Physiology, emotion and psychosomatic illness. Amsterdam and New York: Associated Scientific Publishers, 1972, pp 253–280.
- Schrech CB. **Accumulation and long-term effects of stress in fish.** In: Moberg GP and Mench JA (eds). The biology of animal stress. Wallingford: CABI publishing, 2000, pp 147–158.
- Broom DM and Johnson KG. Stress and animal welfare. Amsterdam: Kluwer Academic Publishers, 1993.
- Moberg GP. **Biological response to stress: implications for animal welfare.** In: Moberg GP and Mench JA (eds). The biology of animal stress. Basic principles and implications for animal welfare. Wallingford: CABI Publishing, 2000, pp 1–21.
- Edney ATB. **Reasons for euthanasia of dogs and cats.** *Vet Rec* 1998; 143: 114.
- Heath S. **Behavior problems and welfare.** In: Rochlitz I (ed). The welfare of cats. Amsterdam: Springer, 2007, pp 91–118.
- Salman MD, New JG, Jr, Scarlett JM, et al. **Human and animal factors related to the relinquishment of dogs and cats to 12 selected animal shelters in the United States.** *J Appl Anim Welf Sci* 1998; 1: 207–226.
- Meaney MJ, Moshe S and Seckl JR. **Epigenetic mechanisms of perinatal programming of hypothalamic–pituitary–adrenal function and health.** *Trends Mol Med* 2007; 13: 269–277.
- McCune S. **The impact of paternity and early socialization on the development of cats' behaviour to people and novel objects.** *Appl Anim Behav Sci* 1995; 45: 109–124.
- Plomin R. **Childhood temperament.** In: Lahey BB and Kazdin AE (eds). Advances in clinical child psychology. New York: Plenum Press, 1983, pp 45–92.
- Reisner I, Houpt KA, Hollis NE, et al. **Friendliness to humans and defensive aggression in cats: the influence of handling and paternity.** *Physiol Behav* 1994; 55: 1119–1124.
- Turner DC, Feaver J, Mendl M, et al. **Variation in domestic cat behaviour towards humans – a paternal effect.** *Anim Behav* 1986; 34: 1890–1901.
- Turner DC. **Human–cat interactions: relationships with, and breed difference between non pedigree, Persian and Siamese cats.** In: Podberscek AL, Paul ES and Serpell JA

- (eds). *Companion animals & us: exploring the relationships between people & pets*, Cambridge: Cambridge University Press, 2000, pp 257–271.
- 19 Hart BL, Hart LA and Lyons LA. **Breed and gender behaviour differences: relation to the ancient history and origin of the domestic cat**. In: Turner DC and Bateson P (eds). *The domestic cat. The biology of its behaviour*. 3rd ed. Cambridge: Cambridge University Press, 2014, pp 156–165.
  - 20 Pontier D, Rioux N and Heizmann A. **Evidence of selection on the orange allele in the domestic cat *Felis catus*: the role of social structure**. *Oikos* 1995; 73: 299–308.
  - 21 Sandford R. **Personality in domestic cats (*Felis catus*): identification and description of personality structure, predictive validity, and associations with coat color characteristics**. MS thesis, University of California, Davis, 2010.
  - 22 Munera J. **Domestic cats: coat color and personality**. MS thesis, New College of Florida, 2010.
  - 23 Smith BA and Jansen GR. **Maternal undernutrition in the feline: brain composition of offspring**. *Nutr Rep Int* 1977; 16: 497–512.
  - 24 Karsh EB. **Factors influencing the socialisation of cats to people**. In: Anderson RK, Hart BL and Hart LA (eds). *The pet connection: its influence on our health and quality of life*. Minneapolis, MN: Center to Study Human-Animal Relationships and Environments, University of Minnesota, 1984.
  - 25 Karsh EB and Turner DC. **The human–cat relationship**. In: Turner DC and Bateson P (eds). *The domestic cat: the biology of its behaviour*. Cambridge: Cambridge University Press, 1988, pp 159–177.
  - 26 Kotrschal K, Day J, McCune S, et al. **Human and cat personalities: building the bond from both sides**. In: Turner DC and Bateson P (eds). *The domestic cat: the biology of its behaviour*. 2nd ed. Cambridge: Cambridge University Press, 2010, pp 113–128.
  - 27 Lowe SE and Bradshaw JWS. **Ontogeny of individuality in the domestic cat in the home environment**. *Anim Behav* 2001; 61: 231–237.
  - 28 McCune S. **Temperament and the welfare of caged cats**. MS thesis, University of Cambridge, 1992.
  - 29 Amat M, Ruiz de la Torre JL, Fatjó J, et al. **Potential risk factors associated with feline behaviour problems**. *Appl Anim Behav Sci* 2009; 121: 134–139.
  - 30 Serpell J and Jagoe JA. **Early experience and the development of behaviour**. In: Serpell J and Jagoe JA (eds). *The domestic dog, its evolution, behaviour and interaction with people*. Cambridge: Cambridge University Press, 1995, pp 79–102.
  - 31 Badiani A, Oateas MM, Day HEW, et al. **Amphetamine-induced behavior, dopamine release, and c-fos mRNA expression: modulation by environmental novelty**. *J Neurosci* 1998; 18: 10579–10593.
  - 32 Gagliano H, Fuentes S, Nadal R, et al. **Previous exposure to immobilisation and repeated exposure to a novel environment demonstrate a marked dissociation between behavioral and pituitary–adrenal responses**. *Behav Brain Res* 2008; 187: 239–245.
  - 33 Rochlitz I. **Recommendations for the housing of cats in the home, in catteries and animal shelters, in laboratories and in veterinary surgeries**. *J Feline Med Surg* 1999; 1: 181–191.
  - 34 Carlstead K, Brown JL and Strawn W. **Behavioural and physiological correlates of stress in laboratory cats**. *Appl Anim Behav Sci* 1993; 38: 143–158.
  - 35 Heath S and Wilson C. **Canine and feline enrichment in the home and kennel: a guide for practitioners**. *Vet Clin Small Anim* 2014; 44: 427–449.
  - 36 Rochlitz I. **A review of the housing requirements of domestic cats (*Felis silvestris catus*) kept in the home**. *Appl Anim Behav Sci* 2005; 93: 97–109.
  - 37 Young RJ. **Environmental enrichment: an historical perspective**. In: Young RJ (ed). *Environmental enrichment for captive animals*. Wheathampstead: Blackwell Publishing, 2003, pp 1–2.
  - 38 Jensen P and Toates FM. **Who needs ‘behavioural needs’? motivational aspects of the needs of animals**. *Appl Anim Behav Sci* 1993; 37: 161–181.
  - 39 Pryor PA, Hart BL, Bain MJ, et al. **Causes of urine marking in cats and effects of environmental management on frequency of marking**. *J Am Vet Med Assoc* 2001; 219: 1709–1713.
  - 40 Landsberg G, Hunthausen W and Ackerman L. **Feline destructive behaviour**. In: Landsberg G, Hunthausen W and Ackerman L (eds). *Handbook of behavior problems of the dog and cat*. 2nd ed. Philadelphia, PA: Elsevier Saunders, 2003, pp 263–268.
  - 41 Turner DC. **The ethology of the human–cat relationship**. *Schweiz Arch Tierheilk* 1991; 133: 63–70.
  - 42 Heidenberger E. **Housing conditions and behavioural problems of indoor cats as assessed by their owners**. *Appl Anim Behav Sci* 1997; 52: 345–364.
  - 43 Beaver BV. **Feline social behavior**. In: Beaver BV (ed). *Feline behavior. A guide for veterinarians*. 2nd ed. St Louis, MO: Saunders, 2003, pp 127–163.
  - 44 Landsberg G, Hunthausen W and Ackerman L. **Feline aggression**. In: Landsberg G, Hunthausen W and Ackerman L (eds). *Handbook of behavior problems of the dog and cat*. 2nd ed. Philadelphia, PA: Elsevier Saunders, 2003, pp 427–453.
  - 45 McKeown DB, Luescher UA and Machum MA. **Aggression in feline housemates: a case study**. *Can Vet J* 1988; 29: 742–744.
  - 46 Houpt KA. *Domestic animal behavior for veterinarians and animal scientists*. 3rd ed. Iowa, IA: Iowa State University Press, 1998.
  - 47 Levine E, Perry P, Scarlett J, et al. **Inter-cat aggression in households following the introduction of a new cat**. *Appl Anim Behav Sci* 2005; 90: 325–336.
  - 48 Herron ME. **Advances in understanding and treatment of feline inappropriate elimination**. *Top Companion Anim Med* 2010; 25: 195–202.
  - 49 Koolhaas JM, Bartolomucci A, Buwalda B, et al. **Stress revisited: a critical evaluation of the stress concept**. *Neurosci Biobehav Rev* 2011; 35: 1291–1301.
  - 50 Loyallo WR. *Stress & health: biological and psychological interactions*. 2nd ed. Thousand Oaks, CA: Sage Publications, 2005.
  - 51 Sapolsky RM. *Why zebras don’t get ulcers*. 3rd ed. New York: Henry Holt, 2004.
  - 52 Weinberg J and Levine S. **Psychobiology of coping in animals: the effects of predictability**. In: Levine S and Ursin H (eds). *Coping and health*. New York: Plenum Press, 1980, pp 39–59.

- 53 Griffin J. **Stress and immunity: a unifying concept.** *Vet Immunol Immunop* 1989; 20: 263–312.
- 54 Bannasch MJ and Foley JE. **Epidemiologic evaluation of multiple respiratory pathogens in cats in animal shelters.** *J Feline Med Surg* 2005; 7: 109–119.
- 55 Gaskell RM and Povey RC. **Experimental induction of feline viral rhinotracheitis virus re-excretion in FVR-recovered cats.** *Vet Rec* 1977; 100: 128–133.
- 56 Tanaka A, Wagner DC, Kass PH, et al. **Associations among weight loss, stress, and upper respiratory tract infection in shelter cats.** *J Am Vet Med Assoc* 2012; 240: 570–576.
- 57 Enck P and Holtmann G. **Stress and gastrointestinal motility in animals: a review of the literature.** *J Neurogastroenterol Motil* 1992; 4: 83–90.
- 58 Stella JL, Lord LK and Buffington CAT. **Sickness behaviors in response to unusual external events in healthy cats and cats with feline interstitial cystitis.** *J Am Vet Med Assoc* 2011; 238: 67–73.
- 59 Lambert GP. **Stress-induced gastrointestinal barrier dysfunction and its inflammatory effects.** *J Anim Sci* 2009; 87: 101–108.
- 60 Buffington CAT. **Idiopathic cystitis in domestic cats – beyond the lower urinary tract.** *J Vet Intern Med* 2011; 25: 784–796.
- 61 Cameron ME, Casey RA, Bradshaw JWS, et al. **A study of environmental and behavioural factors that may be associated with feline idiopathic cystitis.** *J Small Anim Pract* 2004; 45: 144–147.
- 62 Buffington CAT and Pacak K. **Increased plasma norepinephrine concentration in cats with interstitial cystitis.** *J Urol* 2001; 165: 2051–2054.
- 63 Buffington CAT, Chew DJ and Woodworth BE. **Feline interstitial cystitis.** *J Am Vet Med Assoc* 1999; 215: 682–687.
- 64 Panconesi E and Hautman G. **Psychophysiology of stress in dermatology.** *Clin Dermatol* 1996; 14: 399–422.
- 65 Virga V. **Behavioral dermatology.** *Vet Clin Small Anim* 2003; 33: 231–251.
- 66 Landsberg G, Hunthausen W and Ackerman L. **Stereotypic and compulsive disorders.** In: Landsberg G, Hunthausen W and Ackerman L (eds). *Handbook of behavior problems of the dog and cat*. 2nd ed. Philadelphia, PA: Elsevier Saunders, 2003, pp 195–225.
- 67 Koblenzer CS. **Itching and the atopic skin.** *J Allergy Clin Immunol* 1999; 104: 109–113.
- 68 Shanley K. **Pathophysiology of pruritus.** *Vet Clin North Am Small Anim Pract* 1988; 18: 971–981.
- 69 Scheich G, Florin I, Rudolph R, et al. **Personality characteristics and serum IgE level in patients with atopic dermatitis.** *J Psychosom Res* 1993; 37: 637–642.
- 70 Rochlitz I. **Feline welfare issues.** In: Turner DC and Bateson P (eds). *The domestic cat. The biology of its behaviour*. 3rd ed. Cambridge: Cambridge University Press, 2014, pp 131–153.
- 71 Armstrong PJ and Blanchard G. **Hepatic lipidosis in cats.** *Vet Clin Small Anim* 2009; 39: 599–616.
- 72 Carr JA. **Stress, neuropeptides, and feeding behavior: a comparative perspective.** *Integr Comp Biol* 2002; 42: 582–590.
- 73 Manteca X. **Conducta de termorregulación y de alimentación.** In: Manteca X (ed). *Etología veterinaria*. Sant Cugat del Vall: Multimèdica Ediciones Veterinarias, 2009, pp 75–110.
- 74 Maniam J and Morris MJ. **The link between stress and feeding behaviour.** *Neuropharmacol* 2012; 63: 97–110.
- 75 Martí O, Martí J and Armario A. **Effects of chronic stress on food intake in rats: influence of stressor intensity and duration of daily exposure.** *Physiol Behav* 1994; 55: 747–753.
- 76 Schulz S and Laessle RG. **Stress-induced laboratory eating behavior in obese women with binge eating disorder.** *Appetite* 2012; 58: 457–461.
- 77 Cavagnini F, Croci M, Putignano P, et al. **Glucocorticoids and neuroendocrine function.** *Int J Obes Relat Metab Disord* 2000; 24 Suppl 2: S77–S79.
- 78 Green PK, Wilkinson CW and Woods SC. **Intraventricular corticosterone increases the rate of body weight gain in underweight adrenalectomized rats.** *Endocrinology* 1992; 130: 269–275.
- 79 Strack AM, Sebastian RJ, Schwartz MW, et al. **Glucocorticoids and insulin: reciprocal signals for energy balance.** *Am J Physiol Regul Integr Comp Physiol* 1995; 268: 142–149.
- 80 Bowen J and Heath S. **Feline compulsive disorders.** In: Bowen J and Heath S (eds). *Behaviour problems in small animals. Practical advice for the veterinary team*. Oxford: Elsevier Saunders, 2005, pp 177–184.
- 81 Luescher AU. **Diagnosis and management of compulsive disorders in dogs and cats.** *Vet Clin North Am Small Anim Pract* 2003; 33: 253–267.
- 82 Mason G and Rushen J. **Stereotypic animal behaviour: fundamentals and applications to welfare.** 2nd ed. Wallingford: CABI, 2006, pp 325–356.
- 83 Wiepkema PR and van Adrichem PWM. **Biology of stress in farm animals.** Dordrecht: Nijhoff, 1987.
- 84 Wiepkema PR and Schouten WGP. **Stereotypies in sows during chronic stress.** *Psychother Psychosom* 1992; 57: 194–199.
- 85 Schouten WG and Wiegant VM. **Individual responses to acute and chronic stress in pigs.** *Acta Physiol Scand Suppl* 1997; 640: 88–91.
- 86 Beaver BV. **Feline grooming behavior.** In: Beaver BV (ed). *Feline behavior. A guide for veterinarians*. 2nd ed. St Louis, MO: Saunders, 2003, pp 311–321.
- 87 De Lahunta A and Glass EN. **Veterinary neuroanatomy and clinical neurology.** 3rd ed. St Louis, MO: Saunders Elsevier, 2009.
- 88 March PA, Fischer JR, Potthoff A, et al. **Electromyographic and histological abnormalities in epaxial muscles of cats with feline hyperesthesia syndrome.** *J Vet Intern Med* 1999; 13: 238.
- 89 Hart BL. **The role of grooming activity.** *Feline Pract* 1976; 6: 14–16.
- 90 Schwartz S. **Animal behavior case of the month.** *J Am Vet Med Assoc* 1996; 208: 1813–1814.
- 91 Luescher AU. **Repetitive and compulsive behavior in dogs and cats.** In: Horwitz D and Mills D (eds). *BSAVA manual of canine and feline behavioural medicine*. 2nd ed. Gloucester: British Small Animal Veterinary Association, 2009, pp 229–236.
- 92 Bowen J. **Miscellaneous behaviour problems.** In: Horwitz DF, Mills DS and Heath S (eds). *BSAVA manual of canine and feline behavioural medicine*. Gloucester: British Small Animal Veterinary Association, 2002, p 119.
- 93 Mongillo P, Adamelli S, Bernardini M, et al. **Successful treatment of abnormal feeding behavior in a cat.** *J Vet Behav* 2012; 7: 390–393.
- 94 Bradshaw JWS, Neville PF and Sawyer D. **Factors affecting pica in the domestic cat.** *Appl Anim Behav Sci* 1997; 52: 373–379.

- 95 Ulrich-Lai YM, Ostrander MM and James H. **HPA axis dampening by limited sucrose intake: reward frequency vs. caloric consumption.** *Physiol Behav* 2011; 103: 104–110.
- 96 Ulrich-Lai YM, Christiansen AM, Ostrander MM, et al. **Pleasurable behaviors reduce stress via brain reward pathways.** *Proc Natl Acad Sci U S A* 2010; 107: 20529–20534.
- 97 Hart BL and Hart LA. **Feline behavioural problems and solutions.** In: Turner DC and Bateson P (eds). *The domestic cat. The biology of its behaviour.* 3rd ed. Cambridge: Cambridge University Press, 2014, pp 202–212.
- 98 Hart BL, Hart LA and Bain MJ. *Canine and feline behavior therapy.* 2nd ed. Ames, IA: Blackwell Publishing, 2006.
- 99 Skeritt GC and Jemmett JE. **The spraying problem. Results and analysis of the Glaxovet/FAB survey.** *Bull Feline Advisory Bureau* 1980; 18: 3–4.
- 100 Blanchard DC and Blanchard RJ. **Stress and aggressive behaviors.** In: Nelson RJ (ed). *Biology of aggression.* New York: Oxford University Press, 2006, pp 275–291.
- 101 Kruk MR, Meelis W, Halász J, et al. **Fast positive feedback between the adrenocortical stress response and a brain mechanism involved in aggressive behaviour.** *Behav Neurosci* 2004; 118: 1062–1070.
- 102 Amat M, Manteca X, Ruiz de la Torre JL, et al. **Evaluation of inciting causes, alternative targets, and risk factors associated with redirected aggression in cats.** *J Am Vet Med Assoc* 2008; 233: 586–589.
- 103 Chapman BL and Voith VL. **Cat aggression redirected to people: 14 cases (1981–1987).** *J Am Vet Med Assoc* 1990; 196: 947–950.
- 104 Dantzer R. **Coping with stress.** In: Stanford SC and Salmon P (eds). *Stress from synapse to syndrome.* London: Academic Press, 1993, pp 167–187.
- 105 Levine S, Coe C and Wiener S. **Psychoneuroendocrinology of stress.** In: Levine S and Busch R (eds). *Psychoendocrinology.* New York: Academic Press, 1989, pp 181–207.
- 106 Overli O, Korzan WJ, Larson ET, et al. **Behavioral and neuroendocrine correlates of displaced aggression in trout.** *Horm Behav* 2004; 45: 324–329.
- 107 Nelson RJ. **Stress.** In: Nelson RJ (ed). *An introduction to behavioral endocrinology.* 2nd ed. Sunderland, MA: Sinauer Associates, 2000, pp 557–591.
- 108 Nelson RJ. **Stress and aggressive behaviours.** In: Nelson RJ (ed). *Biology of aggression.* New York: Oxford University Press, 2006, pp 275–291.
- 109 Neilson JC. **Fear of places or things.** In: Horwitz D and Mills DS (eds). *BSAVA manual of canine and feline behavioral medicine.* Gloucester: BSAVA, 2002, pp 173–180.
- 110 Domjan M. *The essentials of conditioning and learning.* 2nd ed. Belmont, CA: Wadsworth/Thomson Learning, 2000.
- 111 Crowell-Davis SL, Barry K and Wolfe R. **Social behavior and aggressive problems of cats.** *Vet Clin North Am Small Anim Pract* 1997; 27: 549–568.
- 112 Moesta A and Crowell-Davis S. **Intercat aggression – general considerations, prevention and treatment.** *Tierärztl Prax Ausg K Kleintiere Heimtiere* 2011; 2: 97–104.
- 113 Ellis S, Rodan I, Carney HC, et al. **AAFP and ISFM feline environmental needs guidelines.** *J Feline Med Surg* 2013; 15: 219–230.
- 114 Ellis S. **Environmental enrichment: practical strategies for improving feline welfare.** *J Feline Med Surg* 2009; 11: 901–912.
- 115 de Monte M and Le Pape G. **Behavioural effects of cage enrichment in single caged adult cats.** *Anim Welf* 1997; 6: 53–66.
- 116 Hall SL. **Object play in the adult domestic cat, *Felis silvestris catus*.** MS Thesis, University of Southampton, 1995.
- 117 Hall SL, Bradshaw JWS and Robinson IH. **Object play in adult domestic cats: the roles of habituation and disinhibition.** *Appl Anim Behav Sci* 2002; 79: 263–271.
- 118 Gourkow N and Fraser D. **The effect of housing and handling practices on the welfare, behaviour and selection of domestic cats (*Felis silvestris catus*) by adopters in an animal shelter.** *Anim Welf* 2006; 15: 371–377.
- 119 Holmes RJ. **Environmental enrichment for confined dogs and cats.** In: Holmes RJ (ed). *Animal behaviour – the TG Hungerford refresher course for veterinarians.* Proceedings 214. Sydney: Post Graduate Committee in Veterinary Science, 1993, pp 191–197.
- 120 Hawkins KR. **Stress, enrichment and welfare of domestic cats in rescue shelters.** MS thesis, University of Bristol, 2005.
- 121 Kry K and Casey R. **The effect of hiding enrichment on stress levels and behavior of domestic cats (*Felis silvestris catus*) in a shelter setting and the implications for adoption potential.** *Anim Welf* 2007; 16: 375–383.
- 122 Stella J and Buffington T. **Individual and environmental effects on health and welfare.** In: Turner DC and Bateson P (eds). *The domestic cat: the biology of its behaviour.* 3rd ed. Cambridge: Cambridge University Press, 2014, pp 185–200.
- 123 Bernstein PL and Strack M. **A game of cat and house: spatial patterns and behaviour of 14 cats (*Felis catus*) in the home.** *Anthrozoos* 1996; 9: 25–39.
- 124 Beaver BV. **Feline eliminative behavior.** In: Beaver BV (ed). *Feline behavior: a guide for veterinarians.* 2nd ed. St Louis, MO: Saunders, 2003, pp 246–273.
- 125 Bradshaw JWS, Goodwin D, Legrand-Defrétin, et al. **Food selection by the domestic cat, an obligate carnivore.** *Comp Biochem Physiol* 1996; 114A: 205–209.
- 126 Buffington CAT, Westropp JL, Chew DJ, et al. **Clinical evaluation of multimodal environmental modification (MEMO) in the management of cats with idiopathic cystitis.** *J Feline Med Surg* 2006; 8: 261–268.
- 127 Forrester SD and Roudebush P. **Evidence-based management of feline lower urinary tract disease.** *Vet Clin Small Anim* 2007; 37: 533–558.
- 128 Kerr KR. **Companion animals symposium: dietary management of feline lower urinary tract symptoms.** *J Anim Sci* 2013; 91: 2965–2975.
- 129 Crowell-Davis SL, Curtis TM and Knowles RJ. **Social organization in the cat: a modern understanding.** *J Feline Med Surg* 2004; 6: 19–28.
- 130 Mills D, Karagiannis C and Zulch H. **Stress – its effects on health and behavior: a guide for practitioners.** *Vet Clin North Am Small Anim Pract* 2014; 44: 525–541.

- 131 Overall KL. **Abnormal canine behaviours and behavioral pathologies involving aggression.** In: Overall KL (ed). *Manual of clinical behavioral medicine for dogs and cats.* St Louis, MO: Elsevier, 2013, pp 172–230.
- 132 Herron ME and Buffington CA. **Feline focus: environmental enrichment for indoor cats.** *Compend Contin Educ Vet* 2010; 32: 1–5.
- 133 Mineka S and Zinbarg R. **A contemporary learning theory perspective on the etiology of anxiety disorders.** *Am Psychol* 2006; 61: 10–26.
- 134 Rand JS, Kinnaird E, Baglioni A, et al. **Acute stress hyperglycemia in cats is associated with struggling and increased concentrations of lactate and norepinephrine.** *J Vet Intern Med* 2002; 16: 123–132.
- 135 Stella J, Cronney C and Buffington T. **Effects of stressors on the behavior and physiology of domestic cats.** *Appl Anim Behav Sci* 2013; 143: 157–163.
- 136 Landsberg G, Hunthausen W and Ackerman L. **Pharmacological intervention in behavioral therapy.** In: Landsberg G, Hunthausen W and Ackerman L (eds). *Handbook of behavior problems of the dog and cat.* 2nd ed. Philadelphia, PA: Elsevier Saunders, 2003, pp 117–157.
- 137 Crowell-Davis SL and Murray T. **Introduction.** In: Crowell-Davis SL (ed). *Veterinary psychopharmacology.* Ames, IA: Blackwell Publishing, 2006, pp 3–24.
- 138 Center SA, Elston TH, Rowland PH, et al. **Fulminant hepatic failure associated with oral administration of diazepam in 11 cats.** *J Am Vet Med Assoc* 1996; 209: 618–625.
- 139 Hughes D, Moreau RE, Overall KL, et al. **Acute hepatic necrosis and liver failure associated with benzodiazepine therapy in six cats, 1986–1995.** *J Vet Emerg Crit Care* 1996; 6: 13–20.
- 140 Giorgi M and Yun H. **Pharmacokinetics of mirtazapine and its main metabolites in Beagle dogs: a pilot study.** *Vet J* 2012; 192: 239–241.
- 141 Quimby JM, Gustafson DL, Samber BJ, et al. **Studies on the pharmacokinetics and pharmacodynamics of mirtazapine in healthy young cats.** *J Vet Pharmacol Ther* 2011; 34: 388–396.
- 142 Frank DF, Erb HN and Houpt KA. **Urine spraying in cats: presence of concurrent disease and effects of a pheromone treatment.** *Appl Anim Behav Sci* 1999; 61: 263–272.
- 143 Griffith CA, Steigerwald ES and Buffington CAT. **Effects of a synthetic facial pheromone on behavior of cats.** *J Am Vet Med Assoc* 2000; 217: 1154–1156.
- 144 Hunthausen W. **Evaluating a feline facial pheromone analogue to control urine spraying.** *Vet Med* 2000; 95: 151–155.
- 145 Landsberg G, Hunthausen W and Ackerman L. **Complementary and alternative therapy for behavior problems.** In: Landsberg G, Hunthausen W and Ackerman L (eds). *Handbook of behavior problems of the dog and cat.* 2nd ed. Philadelphia, PA: Elsevier Saunders, 2003, pp 153–166.
- 146 Pageat P and Gaultier E. **Current research in canine and feline pheromones.** *Vet Clin North Am Small Anim Pract* 2003; 33: 187–211.
- 147 Beata C, Beaumont-Graff E, Coll V, et al. **Effect of alphacazepine (Zylkene) on anxiety in cats.** *J Vet Behav* 2007; 2: 40–46.
- 148 Beata C, Beaumont-Graff E, Diaz C, et al. **Effects of alphacazepine (Zylkene) versus selegiline hydrochloride (Selgian, Anipryl) on anxiety disorders in dogs.** *J Vet Behav* 2007; 2: 175–183.
- 149 Overall KL. **Pharmacological approaches to changing behavior and neurochemistry: roles for diet, supplements, nutraceuticals, and medication.** In: Overall KL (ed). *Manual of clinical behavioral medicine for dogs and cats.* St Louis, MO: Elsevier, 2013, pp 458–512.
- 150 Ellis S and Wells DL. **The influence of olfactory stimulation on the behaviour of cats housed in a rescue shelter.** *Appl Anim Behav Sci* 2010; 123: 56–62.