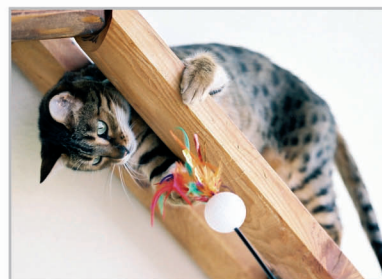
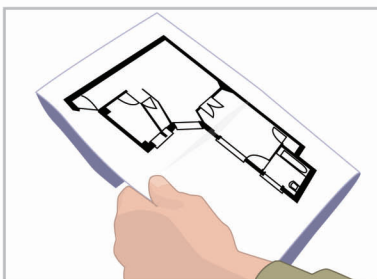


# VETERINARY **focus**

Special edition

The worldwide journal for the companion animal veterinarian



## *How to detect and manage anxiety in the cat*



Claude Béata  
Jon Bowen  
Jaume Fatjó  
Debra Horwitz  
Clara Palestini

# **How to detect and manage anxiety in the cat**

Art director: Arnaud Pouzet  
Editorial coordination: Laurent Cathalan  
Layout: Arnaud Pouzet  
Technical Management: Buena Media Plus

Illustrations: Edouard Cellura

© 2006 Royal Canin  
BP 4  
650 avenue de la Petite Camargue  
30470 Aimargues, France  
Tel.: + 33 (0) 4 66 73 03 00 – Fax : + 33 (0) 4 66 73 07 00  
[www.royalcanin.com](http://www.royalcanin.com)

No part of this publication may be reproduced without the prior consent of the author, his successors or successors at law, in conformance with Intellectual Property (Article I. 112-4). Any partial or full reproduction constitutes a forgery liable to criminal prosecution. Only reproductions (Art.I.122-5) or copies strictly reserved for private use of the copier, and short quotes and analyses justified by the pedagogical, critical or informative nature of the book they are included in are authorised, subject to compliance with the provisions of articles L.122-10 to L.122-12 of the Code of Intellectual Property relative to reprographics.

---

# Contents

	The authors	5
	Introduction	9
<b>1</b>	What is anxiety?	11
<b>2</b>	Anxiety and medicine	21
<b>3</b>	Behavioural problems associated with anxiety	29
<b>4</b>	Reducing and preventing anxiety in cats	41
<b>5</b>	Psychopharmacology	51
<b>6</b>	Myths and FAQs	63
	References	68

*This book has been prepared with the greatest care, taking into account the latest research and scientific discoveries.*

*It is recommended that you refer to drug and food prescriptions and instructions, since they are likely to change. In view of the diversity and complexity of clinical cases for dogs and cats, it is imperative to realize that any supplementary tests and therapeutic treatment described in this book are non-exhaustive. The treatments and solutions proposed can under no circumstances replace examination by a qualified veterinarian. The publisher and authors can in no way be held responsible for any failure of the suggested treatments and solutions.*

---

## The authors



*From left to right: Clara Palestrini, Jon Bowen, Debbie Horwitz, Jaume Fatjó and Claude Béata*

---

### Claude Béata (France)

Claude Béata obtained his doctoral degree in Veterinary Medicine from the École Nationale Vétérinaire de Lyon in 1985. He then obtained a certificate in ethology from the University of Toulon and attended the first class of behavioural veterinarians who graduated from the Écoles Nationales Vétérinaires Françaises (1998).

Claude Béata is also a founding member and a charter diplomate of the European College of Veterinary Behaviour Medicine - Companion Animals (ECVBM-CA). He founded a veterinary clinic in Toulon (France). He developed it from 1985 to 1998 focusing on ethology and behavioural disorders.

Since 1 January 1999, he has devoted his time to all areas related to behavioural disorders in pets. As well as running his own practice, Claude Béata is a travelling

consultant in southern France and works for many clinics. Claude Béata also founded CETACE in order to provide consultancy and expert advice for companies and local communities.

With VétoVision, he developed Logic, the first software to help veterinary generalists diagnosing behaviour disorders.

Claude dedicates much of his time to training. In 1989, he lectured at the AFVAC National Congress and many national and international events (ZooPsy, Wsava, Nanc, etc). He teaches and is on the steering committee of the jury (as well as a member) for the French veterinary behaviourist's certificate.

His book "La psychologie du chien" (Psychology of dogs) published by Odile Jacob in October 2004, aims to make veterinary zoopsychiatry more widely-known. He also contributed to the book "Pathologie comportementale du

chien" (Behavioural pathology in dogs), published by Éditions Masson.

Claude Béata is president of the association ZooPsy (veterinary behaviourists), vice-president of GECAF (AFVAC) and treasurer of the European College (ECVBM-CA).

---

### Jon Bowen (UK)

Jon Bowen graduated from the Royal Veterinary College (RVC) in 1992 and spent several years in small animal general practice. Having always had an interest in ethology, he moved into companion animal behavioural medicine, having completed a postgraduate diploma in companion animal counselling at Southampton University.

He is the editor of the behavioural section of the Vetstream Canis CD-ROM, and contributed a chapter to the current BSAVA Manual of Canine and Feline Behavioural Medicine in 2003. With his colleague Sarah Heath, Jon co-wrote the first UK based textbook of veterinary behavioural medicine, which was published by Elsevier Science in November 2005. In 2001 Sarah and Jon founded Sound Therapy 4 Pets Ltd, a UK based company that produces products for behavioural therapy.

Apart from teaching at the RVC, Jon has lectured in Europe, Scandinavia and America, and has spoken at the British Small Animal Veterinary Association (BSAVA) Congress in 2002, 2003, 2004 and 2006, contributing to the behavioural and welfare streams.

Jon runs the behavioural referral clinic at the RVC, as well as a number of other clinics in the South of England. He is studying for a PhD in biological chemistry at Imperial College London, investigating metabolic markers of behavioural disorder.

---

### Jaume Fatjó (Spain)

Jaume Fatjó graduated at the Barcelona School of Veterinary Medicine in 1993 and is a diplomate of the European College of Veterinary Behavioural Medicine – Companion Animals (ECVBM-CA).

Since 1995 he has been responsible for the Animal Behaviour Clinic at the Barcelona School of Veterinary

Medicine. In addition to clinical activity, he has been an associate professor of ethology and animal welfare at the same University since 2004 .

His research focuses on aggressive behaviour in dogs, particularly in the relationship between medical and non-medical causes of aggression, the epidemiology of aggression problems in Spain and the comparison of patterns of visual communication and conflict behaviour between wolves and dogs.

---

### Debra Horwitz (USA)

Dr. Debra Horwitz received her DVM from Michigan State University College of Veterinary Medicine and is a diplomate of the American College of Veterinary Behaviourists.

She has had a referral practice for behavioural problems in companion animals since 1982 and presently her practice is located in St. Louis, Missouri. She is a frequent lecturer in both North America and abroad on behavioural topics to veterinarians and pet owners.

Dr. Horwitz has also taught third year veterinary students and seen clinical cases at the University of Missouri College of Veterinary Medicine. She serves as a behavioural consultant for the Veterinary Information Network, a teaching and clinical resource for veterinarians. She is an editor and a contributor to the BSAVA Manual of Canine and Feline Behavioural Medicine published in July 2002 and she is the behaviour section editor for the 5-Minute Veterinary Consult: Canine and Feline, Third Edition, and Blackwell's Five-Minute Veterinary Consult: Canine and Feline, Fourth Edition and co-author of the Lifelearn Behavior Client Handouts.

Her newest book, Blackwell's Five-Minute Veterinary Consult Clinical Companion: Canine and Feline Behaviour co-authored with Jacqui Neilson will be published in early 2007.

In 1999 Dr. Horwitz was the AAHA award recipient for Excellence in Companion Animal Behaviour and the "Technician Speaker of the year" at the North American Veterinary Conference. She was president-elect of the American College of Veterinary Behaviourists 2004-2006 and will be the president 2006-2008.

---

## Clara Palestini (Italy)

Dr. Clara Palestini graduated at the Faculty of Veterinary Medicine of the University of Milan, Italy, in 1995. She has been working full time in behaviour since 1997 when she started a 3-years Internship related to the activities of the Post Graduate Specialisation School in Applied Ethology and Welfare of Domestic Animal.

In 2000 she obtained, with laude, the title of Specialist Applied Ethology and Welfare of Domestic Animals. In 2003 she graduated as PhD in Applied Ethology.

She has been working at the Behavioural Clinic of the University of Milan since 1997.

Clara is a researcher at Faculty of Veterinary Medicine, University of Milan and she lectures at the Specialisation

School in Applied Ethology and Welfare of Domestic Animals. She also lectures at national and international meetings including courses on behavioural medicine for the European School of Advanced Veterinary Studies.

Dr. Palestini is board certified through the European College of Veterinary Behavioural Medicine (ECVBM-CA), member of the European Society of Veterinary Clinical Ethology (ESVCE), Counsellor and Founder Member of the Italian Society of Specialists in Applied Ethology (AISEAB), founder Member and Member of the scientific committee of ASETRA (Associazione di Studi Etologici e Tutela della Relazione con gli Animali).

Her research interests are the separation-related problems in dogs and in particular on the human-dog attachment bond. ■





---

# Introduction

Why a Focus Special Edition on anxiety in cats?

First, because cats are not as close to humans as dogs from a behavioural standpoint. This means they are more often victim of their owners' misunderstanding and ignorance, particularly since - in our modern societies - their lifestyles expose them more to human error.

Also, because anxiety makes them vulnerable to many other diseases: when their behavioural needs are not met, cats may very rapidly develop a state of anxiety and the behavioural component is so great in this species that it should be considered systematically in all ailing cats.

Finally, because veterinarians and their staff play an essential role in educating owners to the extent that - unlike the case with dogs - they are the only professionals involved! Anxiety is not easily detected since almost all cats brought in for consultation are under stress and practitioners must undertake meticulous analysis to make the difference between simple stress and true anxiety.

For all these reasons, Royal Canin brought together a team of five veterinary surgeons specialised in behaviour, to make an update on anxiety - here in its pathological dimension - to assist practitioners in detecting, controlling and preventing it in the cat.



**Philippe Marniquet**

DVM

Head of Scientific Communication

Royal Canin



# 1. What is anxiety?

## > Summary

In order to find the most effective methods for modifying and preventing problem behaviour in cats, it is essential to understand the processes that underlie the emotion of anxiety and the behavioural responses that result from it. A typical feature of anxiety-related behavioural disorders is an inappropriate fear response when the animal anticipates a situation or stimulus that might be unpredictable or dangerous.

Anxious animals can present a broad variety of signs (flattened posture, hypervigilance, dilated pupils, lip-licking, etc.) and behaviours (elimination, changes in habit and social relationships, aggressiveness, etc.). The intensity and frequency with which these are displayed can vary from one individual to another and they are correlated with physiological changes aimed at preparing the animal to respond to the danger that it anticipates. So anxiety may arise from a number of different causes and combinations of factors.

## 1/ Definition

In the field of behavioural veterinary medicine, it is recognised that anxiety-related responses play an important part in the development and expression of several behavioural disorders in household cats.

It is therefore important to know the function, the nature and the consequences of these responses within this species, in order to understand how these behavioural problems arise and how they can be solved (Casey, 2002). There is a common tendency to use the terms fear and anxiety as if they were interchangeable.

However, although they are both emotional responses entailing the same behavioural and physiological mechanisms (consisting of a stress-response), their different meanings should be clarified.

Fear is an adaptive emotional response to an existing stimulus/situation that the animal perceives as potentially dangerous. In fear, the emotional response starts as soon as the animal perceives the presence of

the threat and triggers the stress-response (Casey, 2002). Anxiety is the apprehensive anticipation of a stimulus/situation that the animal perceives as unpredictable or dangerous. In anxiety, the animal adopts a preparatory behavioural and somatic response to a situation or a stimulus that might occur.

It is essential to understand the processes underlying anxiety responses in household pets in order to find out why specific behaviour occurs in certain circumstances and the most effective methods for changing and preventing it.

## 2/ The biological basis of anxiety-related behaviour

As already stated, fear is an adaptive response that is essential for survival, since it enables the animal to avoid potentially dangerous situations. Many fears are innate and species-specific. There is no need, for example, to

teach a mouse to be afraid of the smell of a cat (Berton *et al*, 1998). Others, however, are learnt: contact with a hot surface is usually sufficient to ensure that, from then on, the animal will fear such contact. The adaptive value of fear is therefore obvious. But fear is not the most appropriate or adaptive response to every situation. The inappropriate expression of fear characterises anxiety-related disorders (Bear *et al*, 2001).

Anxiety and fear are usually evoked by potentially dangerous stimuli or those perceived by the animal as such. These are called stressors and the animal's reaction to them is manifested as a stress-related response.

The response of an organism to a stressor is to initiate physiological changes (increased activity of the autonomous sympathetic system and reduction of the parasympathetic system with consequent vasodilatation in the vital organs; increased heart rate and cardiac output accompanied by faster breathing and decreased activity of the gastrointestinal and reproductive organs) and behavioural changes (fight-flight). These prepare the body to deal with a situation and maximise the animal's ability to respond to it (Casey, 2002).

These behavioural responses effectively distance the animal from the source of stress and, consequently, the stress response fades rapidly.

Stress responses become problematical when an animal is unable to control the situation or to escape from it by means of an appropriate behavioural response (Weiss, 1972). In these cases, negative effects on the physical and emotional health of the individual occur as a consequence of the prolonged stress response.

The typical feature of anxiety-related behavioural disorder is an inappropriate stress response when no stressor is present, or when it is not potentially dangerous (Bear *et al*, 2001). So there is either a false anticipation, or a false estimation, of the threat.

In this context, the behavioural response can be described as "abnormal", since the behavioural pattern exhibited by the animal is not phylogenetically adaptive for that species and is consequently not effective in distancing the individual from the source of stress or in resolving the situation causing the anxiety.

In these animals, not only does anxiety begin automatically whenever the animal encounters a particular situation or stimulus, but it also often causes a problem of

generalisation in respect of other similar situations or stimuli. In these cases, the stress response cannot fade away because the animal's behaviour cannot diminish a threat that is, in fact, non-existent. So instead, it becomes prolonged and chronic.

When stress is chronic, the animal will exhibit additional inappropriate or excessive behavioural responses with the aim of lowering the level of a prolonged stress response and, consequently, its harmful effect (Dantzer & Mormede, 1981).

If repeated, this abnormal behaviour can rapidly become a learnt response to stress or to stimuli heralding it.

Uncontrolled stress can result in the following consequences:

- Development of displacement activities such as self-licking or grooming (Mason, 1991)
- Development of compulsive behaviours (Mason, 1991)
- "All or nothing" responses (phobias)
- Aggressive responses
- Long-lasting physiological stress-related responses can have harmful or pathological effects on the animal, as in the case of development of interstitial/idiopathic cystitis (Cameron *et al*, 2001).

The term anxiety has both a common and a medical usage. In common use, it refers to subjective feelings or sensations when a person anticipates an unpleasant experience, or it can be used as a general term to describe the emotional state of animals that display hesitancy, hypervigilance and somatic signs of arousal when they anticipate an acutely stressful situation. In this text we are talking about anxiety that is non-functional, pathological and detrimental to the animal. Anxiety of this type can be described as situational/ intermittent or chronic/permanent and the type of anxiety will affect treatment and prognosis (see table top of page 13).

---

### 3/ The causes of anxiety

Although a genetic predisposition has been identified for many anxiety-related behavioural disorders, the specific genes have not yet been identified (Bear *et al*, 2001).

As previously stated, anxiety is characterised by the apprehensive anticipation of danger. So it is clear that the nature of the danger may vary from one individual or species to another. This is true in respect of proximate

ANXIETY	situational/intermittent	chronic/permanent
Aggressive response	+++	0
Autonomic nervous system	++	0
Displacement activities	+/-	+++

causal elements. It is also true of remote elements, as these can contribute towards increasing the sensitivity of a subject to a certain type of stimulus perceived as a threat. For example, an environment lacking in stimuli, an alteration during the development period or early separation from the mother may induce increased anxiety in these individuals as adults.

The threshold able to evoke anxiety varies depending on the stimulus and on the individual's predisposition. There can be a single or several more or less specific triggering stimuli.

Anxiety can also be determined by alterations in neurotransmitter systems. Exposure to particularly frightening events or stimuli can create neuro-anatomical or physiological changes in the encephalon such that the anxiety response is initiated "automatically" whenever the animal encounters a particular stimulus or whenever it senses the stressor (Casey, 2002).

### A) Genetic factors (species, breed, individuality)

The physiological response may vary in relation to individual genetic variability, sex and breed.

Some animals can have a genetic predisposition to anxious behaviour. There are considerable differences in reactivity and sensitivity to adverse events from one individual to another (Thomas *et al*, 1972). These differences in terms of "reactivity" tend to predispose some individuals to the development of anxiety-related disorders.

Furthermore, each species is "genetically predisposed" to

be more frightened by certain kinds of stimuli, objects or situations than by others, without any direct negative experience of them.

Genetic predisposition to display fearful behaviours in particular contexts is more obvious in prey species, such as horse or rabbit, where escape behaviour is essential to survival in potentially dangerous situations, than it is in natural predators such as the dog and the cat (Casey, 2002).

### B) Experiences during development

If the cat is not sufficiently or properly accustomed to certain places, persons or objects, they can give rise to anxiety when the cat encounters them (Neilson, 2002).

Experience during development affects the adult animal's fear responses. During the "sensitive period", sometimes called the socialisation period, there is a greater neuronal plasticity which enables the individual to form a personal neurological representation of its social and physical environment. These are the stimuli and events that will be accepted and recognised as "normal". It is hypothesised that stimuli that are encountered during the sensitive period naturally become associated with parasympathetic responses and form a set of "maintenance stimuli" that represent a safe set-point for emotional homeostasis (Appleby & Pluijmakers, 2003). It is therefore probable that the animal will react with sympathetic arousal, fear or anxiety to new events occurring subsequently (McCune, 1995).

In "altricial" species, such as cats, that are born in an

The threshold capable of evoking an anxiety reaction varies depending on the stimulus and on the predisposition of the individual. Anxiety can be due to various different causes and such causes are often the result of a combination of several factors.

early phase of development, the young are exposed to external stimuli during the last stages of development of the central nervous system (CNS). This exposure is under the protective guidance of the mother and is heavily influenced by her own experience. The nature of the environment, therefore, has a particularly strong impact on the final period of neurological development of cats. Prolonged or violent stresses, or non-exposure to any types of stressor, can cause abnormal development of the stress-response system (Casey, 2002).

### C) Earlier learning experiences

The behavioural response of an individual is influenced by the sum of its experiences throughout its lifetime. Specific adverse experiences can be associated with the development of intense anxiety, especially if the experience was particularly aversive. Social influences, too, become important in this context. People's responses to an anxious animal can influence the animal's subsequent reactions to the very stimulus that triggered the anxiety, aggravating the problem (Neilson, 2002). The owner's attempts to reassure the animal can increase the manifestations of anxiety and shape future behavioural and emotional responses. Similarly, punishment may further increase the cat's fear and lead to an escalation of the state of anxiety.

### D) Lack of controllability and predictability of the environment

The most stressful situation for an animal is one in which it has no control over the environment in which it lives and in which it cannot predict what is about to happen.

#### • Social environment

Lack of predictability and controllability in the cat's social environment may be the result of:

- Inconsistent interaction between the owner and the animal
- Lack of obedience training and inconsistent use of commands
- Inappropriate use of punishments
- Lack of routine
- Presence of other animals
- Lack of ability to engage in species typical behaviours

Casual interaction between owner and animal should be avoided and replaced with well-structured interactions, in terms of both the quantity and the quality of the attention paid to the cat by the owner; for example, trying to keep to regular play sessions during the day and encouraging the cat to play skilful games such as fetching a ball (Luescher, 2002).

As already stated, punishment inflicted by owners can aggravate the situation of anxiety or create a state of anxiety where there was none.

### What influences the degree of stress felt?

**Predictability:** If an animal can predict when an event is likely to occur, then it is possible to prepare a suitable response. Predictable events are therefore perceived as being less stressful. Individuals find it very difficult to cope with uncertainty.

**Controllability:** If a response has an effective outcome, then it will enable the animal to take control of a situation or to alleviate its own stress. This also reduces uncertainty and stress.

Symptoms of stress occur under conditions of reduced predictability and/or controllability of the environment or situation.

### Main anxiety predisposing factors

- Genetic factors (species, breed, individuality)
- Experiences during development
- Earlier learning experiences
- Lack of controllability and predictability of the social and physical environment

Daily routine can influence the cat; any alterations such as changes in the number of inhabitants of the house or in working hours, a move to a new home, renovation work, the arrival of a new baby, the absence of the owner, the introduction of new animals into the home, quarrels among co-inhabitants or new animals outside, may be perceived as stressful events (Horwitz, 2002).

In households where there are several cats, interaction between them may be problematical with episodes of passive or active aggressiveness.

#### • Physical environment

A confined, impoverished environment that restricts social interaction, exploration and access to vertical space can lead to a reduction of the cat's ability to regulate its stress reaction. This is particularly true for

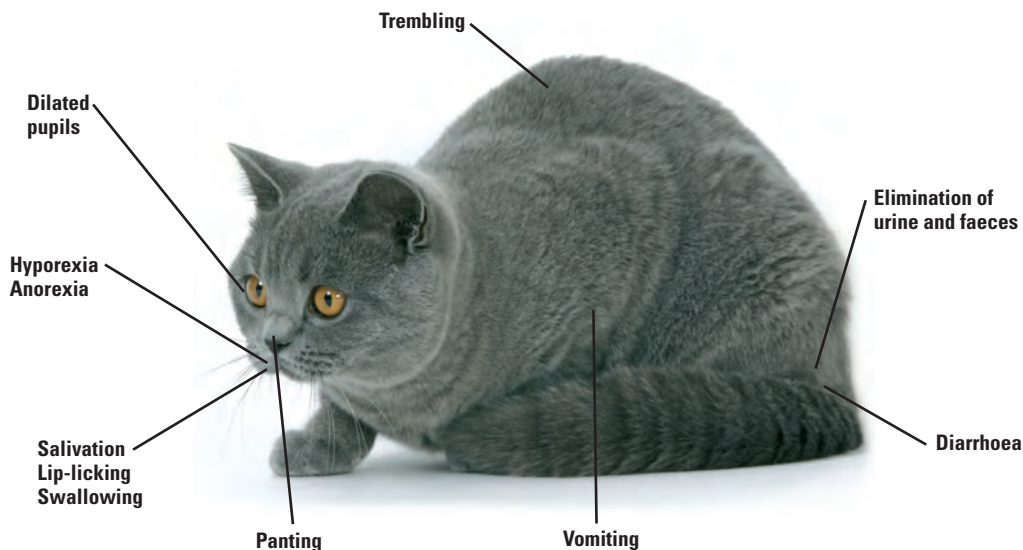
cats that are kept indoors.

Space is just one of the essential resources of the home. It is also necessary to consider the availability of food, water and litter material. In the case of homes with more than one cat, the difficulty of accessing these resources, or competition for appropriating them can be sources of anxiety for the felines of the house (Heath, 2002).

## 4/ Signs of anxiety

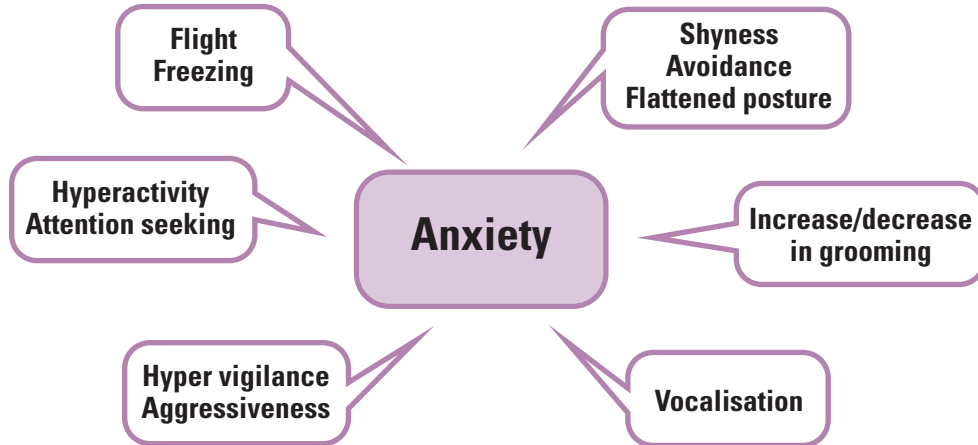
Animals with behavioural problems may show general signs of anxiety, particularly in new situations. Vets' surgeries, certain types of people, other animals, new objects or people are just a few of the stimuli that most

### Organic signs that can be attributed to a state of anxiety





Behavioural signs that can be attributed to a state of anxiety



frequently induce anxious reactions in cats (Neilson, 2002). Anxious animals can display a wide variety of signs, not all of which are necessarily always present, and the intensity and frequency with which they are exhibited can vary from one individual to another.

When an animal is in a state of anxiety, or experiences a situation that induces anxiety, physiological changes occur that have the purpose of preparing it to respond to the danger it senses. Its heart rate accelerates with a consequent increase in cardiac output, its breathing becomes faster, its pupils dilate and the sharpness of its senses increases. The animal may also empty its bladder and bowels. The posture of an anxious animal generally consists of the body lowered, the tail down or tucked under the body and the ears pinned back against the head (Neilson, 2002). By doing this, the animal reduces its visual impact.

Behaviour compatible with a state of anxiety in cats may include increased vigilance, reactivity, motor activity and exploration of the environment. There may also be excessive demands for human attention and reassurance. The anxious animal may display inhibited behaviour such as shyness, caution, avoidance reactions, a tendency to stiffen (freezing), to hide and to escape, or to exhibit aggressive or displacement behaviour such as self-grooming (Frank & Dehasse, 2003).

Other signs noticeable in an anxious cat are licking of the lips, frequent swallowing, salivation, diarrhoea, vomiting, panting, trembling and vocalisation.

## 5/ How can an anxious cat be recognised?

Apart from those signs described in the previous paragraph, a persistent state of anxiety may lead to changes in the animal's entire pattern of behaviour. In an

An anxious cat showing a typical defensive withdrawal posture



© Clara Palestini

anxious cat it is possible to observe alterations in feeding or grooming habits, in its social relations (both towards humans and towards other animals), in its sleeping habits, in its patterns of elimination and marking behaviour and the development of repetitive, stereotyped or compulsive behaviour.

---

## A) Feeding habits

When a cat has an anxiety disorder, it is possible to observe changes in the intensity, frequency or social context of its feeding habits. Changes in feeding behaviour can range from a partial or complete loss of appetite (anorexia), increased appetite or even to the occurrence of pica, that is to say the ingestion of inedible substances. In some cats, for example, the cause triggering pica is a stressful event, such as being taken to a boarding cattery, a move to a new home or the introduction of another cat.

---

## B) Elimination and marking habits

Problems of elimination in the household environment and of territory marking (with urine, by head rubbing or by scratching things) can be due to a situation of stress/anxiety (Houpt, 1991. Frank & Dehasse, 2003). Marking with urine (by spraying urine onto vertical surfaces and occasionally also onto horizontal surfaces) may be connected with an underlying anxious cause. Cats mark objects or people with urine or by rubbing their heads against them in response to stressing events such as, for example, environmental changes. Changes in the physical environment can induce a state of anxiety in a cat, and the same applies to changes in the social environment or in social interaction among cats, especially if there are episodes of passive or active aggressiveness between cats belonging to the same household (Frank & Dehasse, 2003). Scratching may be associated with territory marking or with pathological behaviour such as that due to anxiety (Dehasse & De Buyser, 1993), or it may be used as a displacement activity (Gagnon *et al*, 1993). Scratching is a marking behaviour that probably serves as a form of communication. If there has been a change in the frequency and location of scratching (that is to say if

the cat has increased this activity or has turned its attention to other than its usual surfaces) or if scratching and marking with urine occur together, it is necessary to consider the possibility of a state of anxiety relating to social interaction among the family's cats or household animals, as well as the possible presence of other cats in the neighbourhood (Frank, 2002).

---

## C) Social and relational habits

In anxious animals, changes not only in the type and level of their normal activities but also in the place where they are carried on can be noted. Generally speaking, these animals show a decrease in exploration and play, together with an increased tendency to hide. There will also be a change in interactions with the owner and other animals in the household.

In some cases, there may be aggressiveness. This is because anxiety plays an important part in the development and expression of aggressiveness, both among household cats and between the cat and its owner or other animals. Most cats brought to a vet's surgery due to behavioural problems connected with aggressiveness seem to be motivated to attack due to fear or anxiety (Reisner, 2002). Threatening stimuli may evoke an aggressive response but the threat may be real or simply perceived as such by the cat, and the threshold at which an aggressive reaction occurs may be lowered by internal or external stressing factors (Heath, 2002).

### Changes in behaviour observable in an anxious cat

- Loss of (or increased) appetite
- Soiling in the house, scratching furniture, head rubbing
- Changes in habits and social relations
- Increase or decrease in duration of sleep
- Reduced frequency of functional grooming
- Frequent displacement activities
- Onset of compulsive behaviour

Being a product of anticipation of threat, anxiety plays a very important role in feline aggressiveness. It can also inhibit learning ability by interfering with selective attention.

The owner's reactions can in turn aggravate the problem. It should not be forgotten that the owner's attempts to reassure the animal often only reinforce the behavioural expressions of fear, such as aggressiveness, without improving the underlying emotional state.

If, on the other hand, the owner has punished the cat for its aggressive behaviour, anticipation of the owner's apparent aggressiveness can further increase the cat's fear and lead to an escalation of the problem (Reisner, 2002).

---

#### D) Sleeping habits

Anxious cats frequently show a decrease, or increase, in the number of hours of sleep or changes in sleeping habits, such as sleeping in a hidden away place.

---

#### E) Grooming habits

Anxious animals often show a decrease in functional grooming and self-maintenance behaviour. Alternatively, there can be an *increase* in displacement activity such as non-functional grooming behaviour, even to the extent of

chewing at or pulling out of the fur, or biting and wounding of the skin. This may develop to the level of becoming compulsive.

---

#### F) Displacement activities

Uncontrolled stress can have a whole range of consequences, including development of displacement activity. This has the purpose of redirecting the animal's energy and distracting its attention towards other activities, such as licking of its fur, pacing, polyphagia or polydipsia (Mason, 1991).

---

#### G) Compulsive behaviour

If protracted in duration, stress, frustration and emotional conflict can result in conflicted behaviour giving rise to compulsive disorders.

In cats, abnormal compulsive behaviours can include over-grooming, chewing or tearing at fur, running in circles, tail-chasing, repetitive or intense meowing and vocalising, polyphagia, polydipsia and pica.

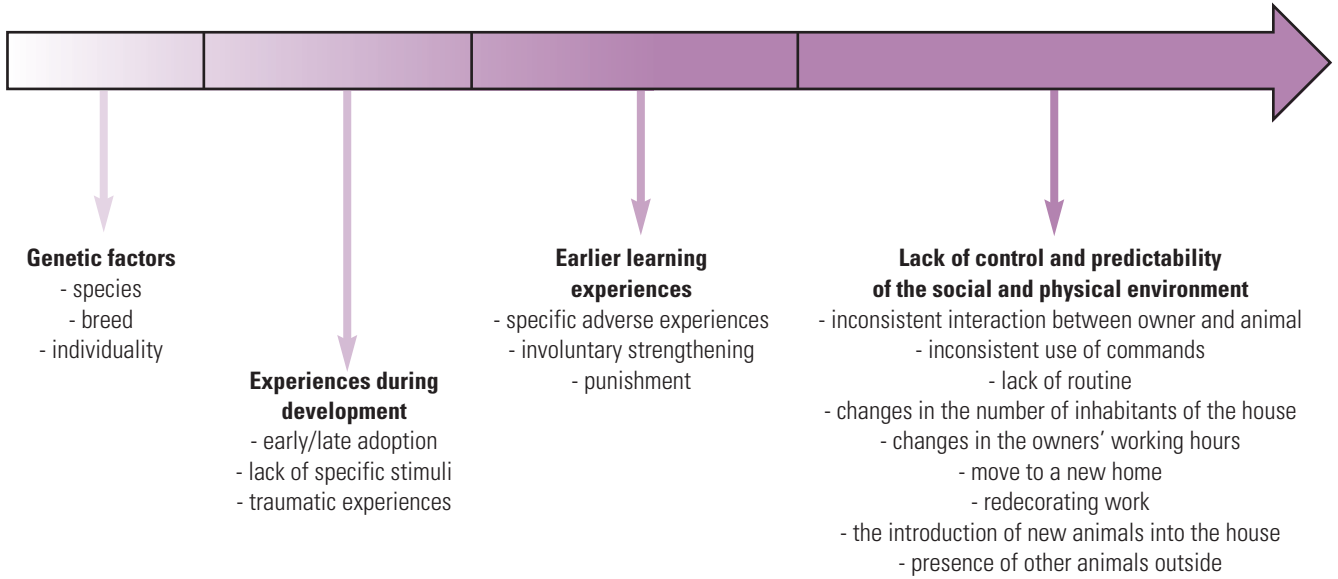
Stress may have a collateral but important role in initiating the onset of compulsive disorders as well as maintaining them (Luescher, 2002). ■

**Causes, signs and behaviour associable with a state of anxiety**

CAUSES	SIGNS	BEHAVIOUR
<p><b>Genetic factors</b></p> <ul style="list-style-type: none"> <li>- species</li> <li>- breed</li> <li>- individuality</li> </ul> <p><b>Experiences during development</b></p> <ul style="list-style-type: none"> <li>- early/late adoption</li> <li>- lack of specific stimuli</li> <li>- traumatic experiences</li> </ul> <p><b>Earlier learning experiences</b></p> <ul style="list-style-type: none"> <li>- specific adverse experiences</li> <li>- involuntary strengthening</li> <li>- punishment</li> </ul> <p><b>Lack of control and predictability of the social and physical environment</b></p> <ul style="list-style-type: none"> <li>- inconsistent interaction between owner and animal</li> <li>- inconsistent use of commands</li> <li>- lack of routine</li> <li>- changes in the number of inhabitants of the house</li> <li>- changes in the owner's working hours</li> <li>- move to a new home</li> <li>- redecorating work</li> <li>- the introduction of new animals into the house</li> <li>- presence of other animals outside</li> </ul>	<p>Flattened posture</p> <p>Dilated pupils</p> <p>Hyperactivity</p> <p>Hypervigilance</p> <p>Attention-seeking</p> <p>Panting</p> <p>Lip-licking</p> <p>Frequent swallowing</p> <p>Salivation</p> <p>Vocalising</p> <p>Quivering</p> <p>Shyness</p> <p>Caution</p> <p>Avoidance</p> <p>Flight</p> <p>Freezing</p> <p>Aggressiveness</p> <p>Diarrhoea</p> <p>Vomiting</p> <p>Elimination of urine and stools</p>	<p><b>Decreased appetite</b></p> <p><b>Soiling in the house and scratching furniture, head rubbing</b></p> <p><b>Change of habits and in social relations</b></p> <ul style="list-style-type: none"> <li>- aggressiveness towards the owner</li> <li>- aggressiveness towards the other cats/animals of the household</li> <li>- looking for hideaways</li> <li>- less sociable/playful</li> <li>- aggressive episodes</li> </ul> <p><b>Less or more hours of sleep</b></p> <p><b>Less grooming</b></p> <p><b>Displacement activities</b></p> <ul style="list-style-type: none"> <li>- fur licking</li> <li>- pacing</li> <li>- polyphagia</li> <li>- polydipsia</li> </ul> <p><b>Onset of compulsive behaviour</b></p> <ul style="list-style-type: none"> <li>- over-grooming</li> <li>- chewing at or pulling out fur</li> <li>- running round in circles</li> <li>- chasing its tail</li> <li>- mewing and vocalising intensely</li> <li>- pica</li> </ul>

---

Main causes of anxiety



## 2. Anxiety and medicine

### > Summary

The list of links between anxiety and the organism could be extended almost indefinitely (immunity, endocrinology, neurology, dermatology, diseases of the lower urinary tract, digestive tract and so on). Rather than producing an exhaustive list, our goal is to invite all practitioners to add signs of anxiety to their semiological record and to address this pathological condition, whether or not as an adjuvant to symptomatic treatment.

### 1/ Introduction

When asked “How many cats suffering from anxiety do you see per month?” veterinary general practitioners often answer with a low figure, typically of around ten. However, this figure tends to refer only to those cases brought to them explicitly for behavioural disorders. According to recent evidence, it is now apparent that the signs of many anxiety disorders are essentially organic and that establishing the particular links between different medical disciplines and stress or anxiety reveals an entire universe of psychopathological anxiety.

Since Descartes, we have made the mistake of separating mind and body, organic and psychological factors. Increasingly, we have the feeling that, regardless of species, health is a matter of equilibrium between information from the environment and the organism’s reactions to it through the essential filter of the brain. In fact the reality is that there is only one “medical practice” that represents the integration of all of the behavioural, emotional and organic factors that contribute to ill health.

We should also take into account the fact that one cat’s reaction to the same situation will differ from another’s, even though they belong to the same breed or even the same family. Thus, each animal with its own genetic and

developmental background, personal history and vulnerability, presents a specific equilibrium and clinical characteristics.

Anxiety is not always the primary presenting symptom in the consultation, because many owners still do not realise that an animal may suffer from anxiety, although intuition may lead them to link certain symptoms to stress or anxiety. Every day, veterinary general practitioners see animals with organic symptoms (vomiting, licking wounds...) whose underlying cause is anxiety.

Just as prominence of the third eyelid should encourage practitioners to seek digestive and other causes that are distant from the physical location of this sign, many organic symptoms should alert them to consider whether the root cause could in fact be anxiety. The structure of territory, recognised by many authors as a major factor triggering anxiety in cats, should be carefully studied in the face of chronic, stubborn or recurrent organic disorders.

There is a bilateral relationship between anxiety and organic symptoms which sometimes reveals a state of anxiety, just as signs of distress, stress, anxiety (using the owners’ vocabulary) may reveal latent organic problems.

In this text, we are sticking to the strict definition of anxiety, whereby “anxiety is a reactive pathological condition with an increase in the likelihood of fear-like symptoms in response to variations in the internal and external environment. The state of anxiety leads to disorganisation of self-control mechanisms and thus a loss of adaptability to variations in the environment” (Pageat, 1995).

We will be exploring the relationship between different systems and this psychopathological condition. For the purpose of clarity, we will maintain the standard division of the organism into systems, without losing sight of what has just been stated.

---

## 2/ Anxiety and general health

The world of animal breeding has long been concerned with the repercussions of stress on the general condition of animals, particularly because of economic loss linked to the poor quality of meat from animals suffering from anxiety.

In the United States, the meat industry evokes average losses of approximately \$5 per beef carcass and the phenomenon of darkened or desiccated pork is also responsible for considerable economic loss (Grandin, 1994. Grandin, 1997).

This situation originates before birth. Environmental and handling conditions may create conditions for harmful chronic stress on mothers that directly affect the viability and physical characteristics of newborns.

This provides proof by default of the importance of psychological balance for health. With the induction of a state of anxiety, it is not easy to achieve good health (Carroll *et al*, 2006. Jones *et al*, 2006).

---

## 3/ Anxiety and immunity

It has long been understood that repeated stress or pervasive anxiety may affect immunity, thereby promoting the onset of illness. Explanatory mechanisms involving benzodiazepine receptors, present both on glial cells and phagocytes and their ligands, have been advanced (Zavala, 1997).

This relationship has been widely identified as a co-factor in the onset of cancer in humans.

Conditions preventing behavioural equilibrium promote the emergence of disease. This is known in poultry farms where stress can cause major mortality when inadequate conditions promote the explosion of infectious pathologies. Closer to our daily practice, the moment when kittens leave the breeder is a delicate period of adaptation combining dietary and environmental changes. It has been demonstrated that, even without dietary change and with efforts to ensure a kitten’s smooth arrival in the new home, anxiety linked to the trauma of losing contact with the mother and littermates and a change in environment is a sufficient factor for sudden loss of immunity. In this way it is easier to understand the classic diseases and infections whose onset corresponds to the stress of adoption.

---

## 4/ Anxiety and endocrinology

### A) Cortisol

Cortisol has always been considered a reliable marker of stress and emotional balance. Although this is true for acute stress, it is hard to rely on this parameter in case of permanent or intermittent anxiety. This leads to a far more general imbalance in which cortisol levels are not a major sign, although the urinary cortisol/creatinine ratio (UCCR) may be higher under more stressful conditions. UCCR does not correlate, for example, with the stress score (McCobb *et al*, 2005).

In elderly cats, this marker remains useful: for corticoadrenal hyper-reactivity, elderly cats usually display both high cortisol levels and a state of anxiety characterised by considerable loss of adaptive ability. With old cats showing signs of involuntional depression (inversion of the nycthemeral cycle, “desperate” meowing), any diagnostic approach must be accompanied by detecting hyper-cortisolaemia.

## B) Thyroid

Hypothyroidism is often mentioned as a co-factor of anxiety in dogs, particularly in aggressive manifestations (Fatjó, 2002. Beaver, 2003), while hyperthyroidism is linked to many behavioural disorders in cats. It should be remembered that the first signs of this still under-diagnosed affliction are those that typically lead to the client consulting a behavioural specialist. These signs include hyperphagia in the absence of diabetes, aggressiveness linked to irritability and hyperaesthesia (Martin *et al*, 2000. Mooney, 2001).

Feline hyperthyroidism is a prime example of a disorder for which behavioural signs are the first indicators of the presence of disease. Weight loss, hypersensitivity to skin contact and aggression through irritation in elderly cats should suggest hyperthyroidism. The value of detailed behavioural semiology is that it can lead to early detection - and thus treatment - of this endocrine disorder. Thus, at the École Nationale Vétérinaire de Maisons-Alfort, a cat brought in for consultation for behavioural disorders resulting from a change in dietary behaviour (it was literally raiding the refrigerator!) was referred on to a specialist in endocrinology. This practitioner found incipient hyperthyroidism, resulting in successful treatment thanks to new therapeutic compounds (Blackwood, 2002).

## C) Prolactin

In recent years, prolactin has also become a subject of interest. This pituitary hormone, which modulates lactation and maternal behaviour in females, also has a role in anxiety. Its effects have been studied in humans, where certain stress-related mechanisms are known and the level of this hormone differentiates between two populations: one with low base levels of prolactin and the other with high base levels. Since this hormone varies greatly in the female cycle and even over a single day, only mean values are used.

In order to simplify what are quite complex findings, we can simply consider what happens in case of sudden stress:

- In the low prolactin population, stress triggers a sudden rise in this hormone. This rise has interesting consequences: it protects the individual against stress-

related ulcers and activates attachment behaviour. So the mother, faced with a threat, gathers her offspring to take them to shelter while being herself protected against the harmful effects of stress.

- In the high prolactin population, stress results in a fall in prolactin levels. There is neither organic protection (against the risk of ulcer) nor adaptive behaviour (protection of those to whom they are attached). This harks back to the definition of anxiety with an incapacity to adaptation and disorganisation of behaviour (Fujikawa *et al*, 2004).

The problem with prolactin is in determining whether such variations correspond to a possible primary cause of anxiety or if, in fact, they are only secondary signs that may be used when objectifying the state of anxiety.

In both cats and dogs, some authors consider prolactin as a factor for refining prognosis and treatment of anxiety-related affections (Pageat, 2005. Daminet & Béata, 2005). This is a promising marker for the future.

## D) Diabetes

The incidence of diabetes is growing in humans and it is also now a major health concern in cats. In both cats and humans, the majority of cases of diabetes are of type 2, often accompanied by clinical obesity (O'Brien, 2002).

It is important to avoid confusing stress-related hyperglycaemia and true diabetes. When investigating hyperglycaemia in cats, most experienced clinicians do not rely

Anxiety can lead to obesity which predisposes to diabetes



© Michele Colin



on a single blood glucose measurement approaching 2.5 g/litre if it has not been validated by repeated measures in a neutral environment (Nelson, 2002).

The tendency to obesity, leading to an increased risk of mature-onset type 2 diabetes, results in large part from poor understanding of basic feline ethology.

There exists a frequent misunderstanding between owners and their cats. Cats are often very strongly attached to their owners and enjoy brief, frequent contacts. Humans, on the other hand, tend to prefer longer, if less frequent, physical exchanges. Cats are animals of habit and ritual, tending to seek out contact at times and in places when they are certain to find those to whom they are attached. Thus cats turn up in the kitchen at mealtimes and this opportunity for contact is too often misinterpreted by the owner as a request for food. This leads to an offering of highly palatable food and treats that the cat will often not refuse, even though feeding was not its objective. In fact, the owner's attention may be conditional upon their seeing the cat show an interest in, or consume, the food. This is a potential explanation for overfeeding and overconsumption.

The other important point is in the lifestyle offered to cats. In the wild, or simply when cats are free to go outdoors, they will spend a great deal of time hunting and burn considerable energy in feeding. Locked up in our flats and apartments, they are deprived of the possibility of such energy expenditure. They have great difficulty constructing a harmonious territory, which may result in permanent anxiety. This condition is characterised by substitutive activities including stereotyped licking or bulimia. In the latter case, not only does the cat expend no energy in hunting and feeding, but also its stereotyped activity to find appeasement leads to overeating. With owners often wishing to feed their cats with excessively palatable products, everything is done to provide a diet that is too energy dense and rich in fat, inevitably leading to obesity and type 2 diabetes.

Treating this endocrine disorder thus involves understanding the animal's behavioural needs, so veterinarians can educate owners to avoid endangering their pets by being overly solicitous.

## 5/ Anxiety and neurology

It is even harder to draw a line between neurology and behavioural disorders. All disorders of the central nervous system, and even more of the brain, have essentially behavioural consequences. It must be remembered that rabies may be suspected in cases of unusual behaviour (sudden aggression in cats, wolves approaching houses and "forgetting" their natural fear).

Aujesky's disease also displays very impressive behavioural symptoms with self-mutilation sometimes going as far as self-decapitation. Cats offer a classic model for studying the onset of epileptic seizures, especially in conjunction with an emotional disorder (Depaulis *et al*, 1997). Not all such episodes are due to anxiety, but the role of anxiety must be considered in the aetiology of disconcerting or confusing clinical signs.

Conversely, a more holistic approach to treatment, in particular by prescribing both medication and behavioural therapy, usually results in a more significant improvement.

A cat displaying partial seizure activity in response to the emotional stress of the "foreign invasion" of its territory by other cats, implicates anxiogenic causes rather than a purely neurological cause.

Animals may display sudden changes in behaviour, appearing restless, unable to find a place to settle and moving about at usual times when they would otherwise be resting. Cats may display very bizarre behaviour or more subtle signs. These symptoms, when not consistent with a pattern of behavioural changes that is characteristic of a specific behavioural disorder, are very good indicators of an underlying organic disorder such as a tumour. Even in the case of classic behavioural disease, such as involuntal depression, an unusually rapid onset may lead to the suspicion of a pituitary or brain tumour (Bagley *et al*, 1999).

The frequently blurred line between neurological and behavioural disorders often raises the issue of treatment. We should remember that, although neurological causes often elude treatment (inoperable tumour, ectopic epileptogenic focus), this does not preclude treating their

behavioural consequences with appreciable results; it is possible to greatly improve the quality of life of these animals and that of their owners. Although pituitary tumours are not candidates for surgery, the accompanying involuntal depression often responds well to the joint use of appropriate treatment and behavioural therapy. Though the animal cannot be saved in the long term, many problems linked to the underlying illness may be obviated to ensure adequate supportive care.

## 6/ Anxiety and dermatology

The French adage “*Être mal dans sa peau*” (being uncomfortable in one’s skin) reflects popular wisdom. In cats, extensive feline alopecia dominates the clinical scene, often leaving owners with the impression that their cats “lick themselves more when they are under stress”.

Although this was long ignored, there is now a consensus that some skin affections may be due to anxiety (Bourdin, 1992. Mege, 1997. Virga, 2003).

First, we must not forget the common embryological origin of skin and the nervous system, and that many studies and observations in human medicine have led to the suspicion of a possible correlation between anxiety and atopy. In support of this, we are reminded of the

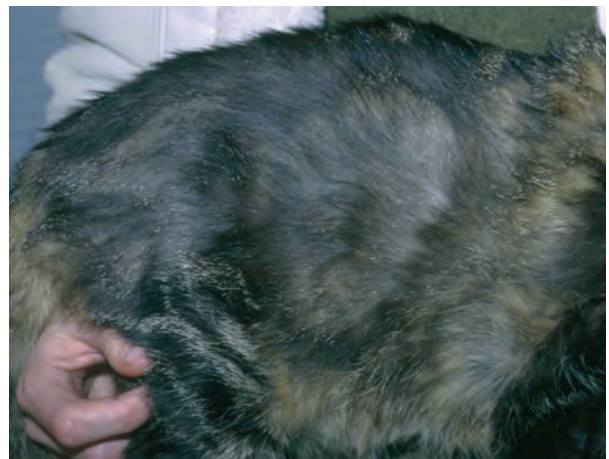
relationship between the three major allergic conditions (rhinitis, asthma and atopy) and symptoms of anxiety. The relationship between anxiety and atopy has recently been demonstrated in dogs (Gerbier, 2002).

Compulsive licking causing extensive alopecia in cats has sometimes been related to anxiety (Sawyer *et al*, 1999). This has been considered a model for obsessive compulsive disorders (OCD) in humans. There again, it would be risky and spurious to consider that all forms of alopecia result from anxiety, but it is just as misleading to ignore this aetiology, thereby depriving the animal of a possible recovery. Authors specialised in both dermatology and behaviour emphasise, for example, the key importance of external parasite and allergy control in halting alopecia, while mentioning the important contribution of psychological factors (Mege, 1997).

The relationship between anxiety and some forms of alopecia is all the more obvious in that they involve the same neuromediators and display similar phases.

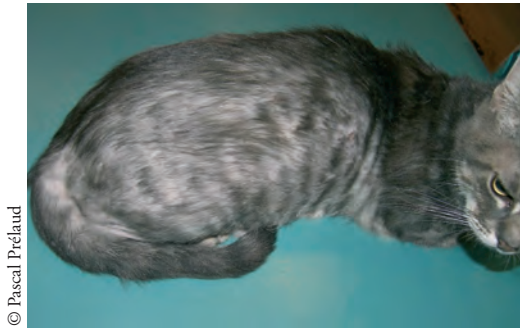
- In the first phase, when the onset of licking is recent, of short duration and stops spontaneously, this behaviour seems to appease the animal who may also seem abnormally restless and touchy. In these cases, the noradrenergic system is predominantly responsible and noradrenergic regulators (like alpha-2 agonists) are typically recommended.
- In the second phase, licking becomes more intense in duration and frequency. Although the animal still stops spontaneously, appeasement is increasingly hard for it

Alopecia, even when it is extensive, is not always considered as abnormal by the owner



© Pascal Prélaud

Anxiety is one of the many aetiologies of extensive alopecia



© Pascal Prédlaud

to achieve. Regulation then appears essentially under dopaminergic control.

- In the final phase, licking virtually never stops spontaneously and it is increasingly difficult to stop using any form of external intervention. The activity has now become stereotyped and the serotonergic system is primarily involved. This state produces the most spectacular cases of cats whose bodies are mostly hairless. It should be noted that owners rarely see their cats licking themselves, unlike the situation with dogs.

It is remarkable to observe that this evolution mimics what can be seen in the aggravation of anxiety with involvement first of the noradrenergic, then the dopaminergic and finally the serotonergic systems. Of course, things are not as linear or clear cut as this model suggests. There is a profound interconnection and interdependence between the different neurotransmitter systems but, from a clinical standpoint, response to various psychotropic drugs often follows this route in the aggravation of both anxiety and licking dermatitis.

So does anxiety result directly from pruritus or vice versa? It is easy to imagine that the habits and emotional and behavioural equilibrium of a cat that licks itself much of the time because of pruritus will be seriously disrupted. Or is pruritus - or at least its intensity - linked to the animal's pre-existing emotional condition? For the same - exogenous or endogenous - cause, the individual's state of emotional balance may be determinant in the intensity of licking. There is probably no need to choose from these two complementary hypotheses. In veterinary

Alopecia may be confined to only one or two areas, such as the belly. A careful examination is always required



© Pascal Prédlaud

medicine, the role of the owner should never be forgotten, since reprimanding licking only aggravates anxiety in an animal already perturbed by unstable territory.

Regarding dermatology and anxiety, although it is difficult to make the difference between cause and consequence, that should not keep us from adopting a holistic therapeutic approach.

## 7/ Anxiety and diseases of the lower urinary tract

In this chapter, we exclude urinary marking phenomena that may be considered to be strictly behavioural.

Feline lower urinary tract disease (FLUTD), and more specifically feline idiopathic cystitis, varies in specific aetiology (Osborne *et al*, 1999) but the hypotheses involving a behavioural cause are increasingly mentioned, subjected to scientific study and supported by several factors.

The only treatments that have shown consistent efficacy are psychotropic drugs of the tricyclic antidepressant family, which are often used as anxiolytics. In severe cases of idiopathic/interstitial cystitis which resist all dietary or conventional medical treatment, only the use of such psychotropic drugs has relieved symptoms. Efficacy may be linked to the compound's anticholinergic effect but the anxiolytic action also appears significant (Chew *et al*, 1998).

In human medicine, idiopathic/interstitial cystitis is a similar disease affecting mostly women. This is a painful recurrent affection, with no infectious cause or crystalluria. Exposure to stress factors increases both the risk of triggering episodes (especially at night) and the feeling of urgency and pain linked to such episodes (Rothrock *et al*, 2001). Feline idiopathic/interstitial cystitis has become a model for human interstitial cystitis.

In recent years, the most recognised authors in this area tend to underscore the importance of the sympathetic system and specific noradrenergic response in both humans and animals with this syndrome. Contrary to what had been assumed, trials have shown that there is no variation in acetylcholine levels in cats but there is variation in the different noradrenergic receptors (Buffington *et al*, 2002). So the efficacy of amitriptyline does seem to be linked to its noradrenergic activity rather than its secondary anticholinergic effects.

The involvement of nor-adrenaline therefore suggests a relationship between this disease and the cat's emotional condition. The most recent hypotheses propose the existence of two cat populations with different responses to indoor life, in other words to an often inappropriate environment. One group adapts, thanks to greater flexibility of their hypothalamopituitary axis. In the other population, minor neuroendocrine disorders increase the vulnerability of cats with greater needs in terms of the quality of their environment (Westropp & Buffington, 2004).

Thus, behavioural disorders have made their official entry into feline organic medicine thanks to FLUTD. Excepting the anxiolytic psychotropic drugs already mentioned, the most often recommended treatments today make use either of soothing pheromones that have shown a tendency towards improvement in controlled studies against a placebo (Gunn-Moore, 2004), or programmes

for enriching the environment very similar to what veterinary behaviourists recommend in cases of anxiety. The MEMO (Multimodal Environmental Modification) programme has shown a significant decrease ( $p < 0,05$ ) over 10 months in the signs of FLUTD as well as of anxiety (attitudes of fear, tachypnea) and a tendency ( $p < 0,1$ ) to fewer aggressive episodes due to irritation (Buffington *et al*, 2006).

---

## 8/ Anxiety and the digestive tract

Many students are understandably convinced that examination stress can have a powerful, direct and rapid effect on digestive motility!

In cats, we also see similar phenomena such as vomiting induced by the appearance of another cat near their territory.

Our clients also report anecdotes about animals suffering systematically from vomiting or diarrhoea in response to certain types of stress. Travel by car is highly anxiogenic for cats and owners regularly request to be able to control the effects of stress on their pets' uncontrollable bowels. But is this a matter of coincidence or can true correlations be established?

The consequences of exam stress on digestive motility were first demonstrated in humans. Since then, a large number of studies have shown the role of anxiety in digestive disorders in animal species.

Observations of cats during the approach of an aggressive dog or another cat, experimentation on dogs and rats subjected to acoustic stress and observations of whales, ungulates and primates - all mammals - illustrate the vulnerability of the digestive tract to anxiogenic situations. A recent study in dogs has shown the correlation between chronic idiopathic gastric disorders and anxiety (Marion, 2002).

In cats, as in dogs but unlike humans, the hypothalamic neuromediator corticotrophin releasing factor (CRF) acts directly on the supra-spinal structures controlling gastrointestinal motility. CRF is also known to be the main factor in activating the corticotropic axis (release of ACTH by the pituitary gland, then of corticoids by the adrenals). In dogs, GABAergic substances inhibiting CRF release

block the disruption induced by acoustic stress (Gue *et al*, 1989). The relationship between anxiety characterised by hyper-responsiveness of the corticotropic axis and organic digestive symptoms seems obvious.

The digestive area is surely where we must begin if we still need to be convinced of the interaction between the physical health of the organism and the state of anxiety.

There is considerable proof of the efficacy of holistic intervention on symptoms as well as on their psychological roots. Thus, in human medicine, a study of differences in response to symptomatic treatment alone or to treatment taking into account other digestive symptoms and anxiety, has shown combined treatment to be statistically more effective. ■

---

## 3. Behavioural problems associated with anxiety

### > Summary

---

Anxiety is an unpleasant emotional state and individuals will alter their patterns of behaviour in order to reduce the anxiety they experience. For the cat this may mean an increase in territorial or confrontational behaviour to deter competitors, the relocation of territorial boundaries, the use of spraying and other undesirable indoor marking behaviour or the displacement of an activity away from a preferred place in order to avoid conflict. These changes may go unnoticed in most households because they occur appropriately in situations that do not impact the pet owner.

The main problems resulting from anxiety are:

- Indoor-marking
- Inappropriate elimination
- Aggression
- Over-grooming

---

### Introduction

Cat ownership now marginally exceeds dog ownership in the UK, as cats are generally regarded as lower maintenance pets that do not need exercise and can be left unattended for longer periods. In many other countries, a similar pattern is emerging and cats are therefore kept in a very wide range of environments, some of which may present greater problems in terms of the incidence of anxiety and behavioural problems. In this section a basic model for understanding anxiety-related problems in the domestic cat will be presented, based on general observations and presentations. This should be treated only as a tool with which to understand an individual problem situation, always taking into account the enormous variation between individual cats, their social relationships and their living arrangements.

---

### 1/ Feline domestication and its consequences for behavioural problems

The natural history of the domestic cat is an interesting one. The first evidence of an intention to keep cats as domestic animals is found in Egypt, about 2600 BC. The actual process of domestication is presumed to have been at least partially self-motivated and correlated with the development of sophisticated agrarian economies and the storage of food providing abundant food in the form of rats and mice. This then presented an ideal opportunity for cats, but one which would naturally favour those with an ability to coexist in close proximity with each other as well as humans and their livestock (Zeuner, 1963. Leyhausen, 1988).

The domestic cat can, and still does, hybridise with its close relative, the wild cat *Felis silvestris* (Pierpaoli, 2003). This repeated breeding with feral and wild cats has helped to ensure that the behavioural patterns of the domestic cat remain very similar to those of their wild counterparts (Turner & Bateson, 2000). Selective breeding has produced a number of breeds with unique physical and behavioural characteristics and these breeds are regularly crossbred with ordinary domestic cats. As a result, there is an enormous variation in behavioural traits between individuals (Feaver, Mendl & Bateson, 1986. Durr *et al*, 1997. Reisner *et al*, 1994), and groups (Durr *et al*, 1997) which can even affect disease risk (Natoli, 2005).

The living conditions of modern domestic cats also differ greatly from country to country. In the UK and much of mainland Europe, there are still feral cat populations and the majority of pet cats have access to gardens and other outdoor spaces. In North America many cats are kept indoors and in Australia and New Zealand cats must not be allowed outdoors at all, other than in secure caged enclosures. The genetic composition of domestic cat populations in different countries is therefore affected by the opportunity to mate with feral and wild cats. The incidence and type of problems experienced by cat owners will relate to this genetic background, the type of environment the cat is kept in and cultural attitudes and expectations of the cat.

## 2/ The importance of territory

Fighting can cause potentially life-threatening damage and debilitation to participants and the strategy for conflict avoidance depends on the social organisation of the species. Being solitary hunters, cats do not use a hierarchical system to reduce conflict. Instead they use a territorial system that prevents conflict by maintaining distance between individuals or groups.

### A) Typical territorial arrangements of free-living cats

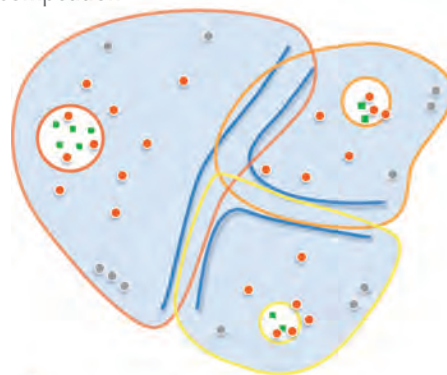
Studies of free-living or feral cats offer some insight into the behaviour and social and territorial organisation of

pet cats. Typically each cat will utilise an area of land that satisfies its needs to hunt and feed, rest and eliminate. Above all, the territory enables the cat to maintain a safe interpersonal distance from other cats. The size of this “home range” is very variable and within this is a smaller core territory where the cat spends more than 80% of its time (Panaman, 1981).

Urine and other scent marks are strategically deposited to convey information to other individuals entering the “home range”. Urine deposited at a given location provides information about the identity of the owner of that area and the time that this urine was deposited. Cats seeking to avoid conflict merely need to respond appropriately to the urine marks that have been left to avoid contact with the individual that deposited them. This is a fundamental part of the cat’s “distance-maintaining” behaviour that reduces risk of face-to-face meetings that can escalate into aggression, and is consistent with observations of territory use (Corbett, 1979. Konecny, 1983).

The cat’s territory is arranged around the core territory where the cat spends the majority of its time and contains the largest density of resting and hunting areas.

Free-living cats maintain separate territories that provide them with the resources they need and reduce the need for conflict and competition



- Peripheral territory
- Core territory
- Hunting site
- Resting site
- Latrine site
- Urine marking

This can be shared with familiar, often related, cats that share a common group odour as a result of rubbing against each other and grooming each other (allorubbing and allogrooming). In the peripheral territory or “home range”, are additional hunting areas and latrines. When territorial boundaries are being correctly observed by other cats, only familiar individuals would normally be encountered within the core territory. Between blocks of territory there may be shared pathways that several cats may use to access different parts of their territory. These are often marked with urine spraying or claw marks. In a properly functioning territory, urine marks are not generally used in the core territory. The maintenance of a territory provides the cat with a high degree of certainty over access to the resources it requires, as well as its ability to utilise them and its ability to avoid conflict by maintaining distance from other cats. This minimises stress for the cat.

Whilst this model describes the behaviour of solitary individuals, cats do form social groups when food and other resources are in excess of their individual needs. These appear to be genuinely social groups, as an analysis of social activity has shown that individuals spend substantially more time in proximity to each other than would be expected by pure chance (Kerby & McDonald, 1988).

## B) Territorial arrangements of the pet cat

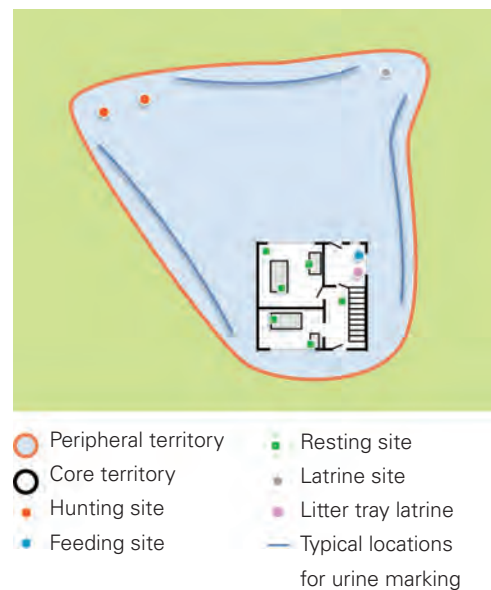
For cats living indoors, the home represents the total space available for all of the cat’s territorial needs. It is hard to estimate the space available to cats with outdoor access in European countries because plot size and feline population density vary greatly between and within countries.

The reduction in available space afforded to pet cats does represent a compromise for many of them, but the degree to which this affects them depends greatly on the individual and its relationship with people, other animals and other cats sharing the living area. Some cats may adapt very easily while others manage less well. Major factors are the individual’s requirement for interpersonal distance and the need to perform certain activities, such as feeding and elimination, in privacy.

In general, the domestic environment places limitations on most cats. There may be very few suitable marking locations in the pet cat’s territory. The core territory within and around the home may be overlooked from the outside and both household and garden may be shared with, or traversed daily by, a number of other cats that may or may not be part of a functioning social group. There may be a single feeding area and few opportunities to hunt or rest away from other cats. The peripheral territory can be small, highly fragmented or unreliably accessible. Latrines, in the form of litter trays, may be positioned in undesirable locations within the cat’s territory, in busy passageways or close to other resources such as feeding or resting sites. In a multi-cat household, cats with differing temperaments and sociability are thrown together to make the best of a situation which, in the case of indoor only cats, they may be unable to escape. Even for indoor-outdoor cats, the lure of the availability of highly desirable resources and the stress of cohabiting with other cats may create an uneasy equilibrium.

As the boundary of the cat’s territory decreases and allocation of resources changes, this has the potential to reduce the cat’s certainty in its ability to control territory and gain access to the resources. This uncertainty

The typical layout of resources (latrines, resting sites) around the territory of a pet cat





contributes to stress for the cat, but the severity, duration and behavioural effects of this stress will vary enormously between individuals.

Despite this, most cats still manage to maintain an apparently normal and functional pattern of behaviour and territory marking with facial and flank marks predominating inside the home and, where the opportunity is available, urine and claw marks around the more peripheral part of their territory. They find suitable opportunities to use acceptable indoor and outdoor latrines and resting places. Even cats that are kept entirely indoors may find ways to satisfactorily extend the space available to them beyond the floor area of the home by accessing shelves, furniture and other high places to maintain acceptable interpersonal distances from each other. However, minor alterations in the social group, the health of individual cats or resource access can upset this balance.

### 3/ Behavioural problems associated with anxiety

In cases that involve underlying anxiety, several of these features may be present intermittently, develop over a period of time or occur together. For example, it is likely that an anxious cat will not only go to the toilet in the house but also may groom excessively and show increased irritability and aggressiveness.

Despite the fact that these individual behaviour problems are part of a spectrum of behaviour that is associated

with anxiety, it is important to be able to identify the specific features that differentiate between elimination and marking problems, as well as between different forms of aggression.

Resolving these problems involves removing the specific points of pressure that cause uncertainty, stress and anxiety so that the cat's pattern of behaviour can return to normal.

#### A) Indoor marking

Indoor urine and claw marking are two of the commonest feline behavioural problems presented in the UK and in other countries.

Before beginning to deal with situations in which urine has been found within the home, it is important to determine whether this is due to spraying or elimination (see box below).

Some cats with outdoor access will visit a number of homes and may in fact not treat their "owner's" home as the core of their territory. So it is important to establish that the home is actually part of each resident cat's core territory:

- Is the owner's home the place where the cat eats, grooms, rests and spends the majority of its time when it is not outside?
- Did the cat ever establish a routine of leaving facial and flank marks within the home?

Assuming that the problem cat is in fact resident, there are several common patterns of spraying behaviour that are indicative of different sources of stress.

#### Differentiating between urine marking and toileting

##### Urine marking

- Smaller volume of urine passed
- Urine has a strong, musty odour and leaves an oily looking deposit
- Urine is deposited in highly visible locations
- Characteristic posture; urine passed standing up with tail erect and twitching, perhaps with paddling of feet

##### Urinary elimination

- Larger volume of urine passed
- Urine has a weak odour, is watery and does not leave a deposit
- Urine is deposited in more concealed locations
- Characteristic posture; urine passed crouched, occasionally standing up, but with no tail twitching or foot paddling

For a single cat living in a typical home, the territory usually encompasses everything that the cat needs. If urine marking occurs, it is at the periphery of the territory and not inside the home which would serve to keep other cats away from the core territory.

**Increases in stress due to a decrease in existing territory size and accessibility**

Territory size can be reduced as a result of increased feline population density and competition for space either inside or outside of the home, or due to a resident cat's problems with territorial maintenance. Reasons for a cat having problems with territorial maintenance could include:

- Debilitation or disease.
- Intermittent or incomplete access to the territory, preventing the cat from patrolling, defending and marking the area effectively either inside or outside.
- Fear of other animals in the neighbourhood or home (foxes, dogs etc).

A reduction in the cat's existing territorial dimensions can have certain consequences:

- Some resource locations become inaccessible, such as the more distant latrine sites.
- The owner may see increased spraying and claw marking in the garden closer to the house or indoors.
- If a suitable latrine is not available in the garden or the house, there is a risk of intermittent housesoiling.
- The cat may spend more time in and around the home or certain areas in the home, as there is a smaller

territory to patrol and fewer opportunities to hunt. This can lead to increased competition with other resident cats.

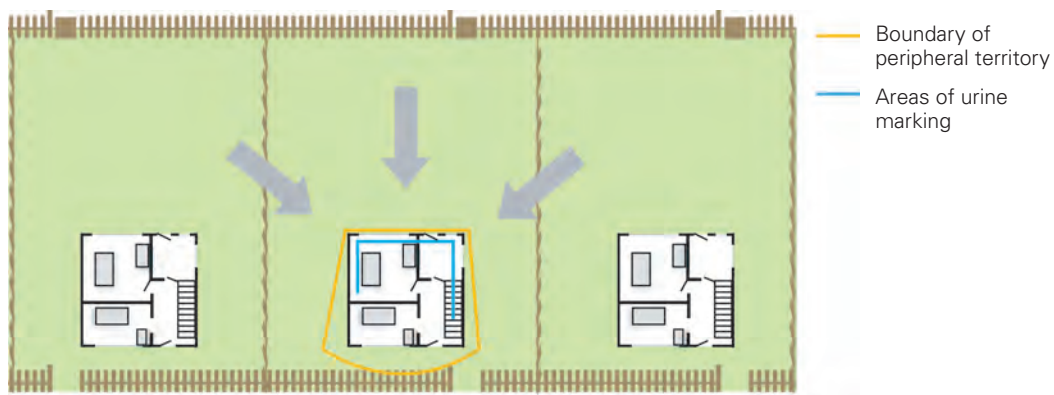
If the cat shares the home with one or more other cats, this is likely to lead to increased competition for dwindling resources. Whether in a multi-cat household or not, the cat is beginning to suffer from increased uncertainty regarding resource access and availability, which increases stress. This creates a risk of occasional spray marking in the home.

**House-bound and indoor-only cats**

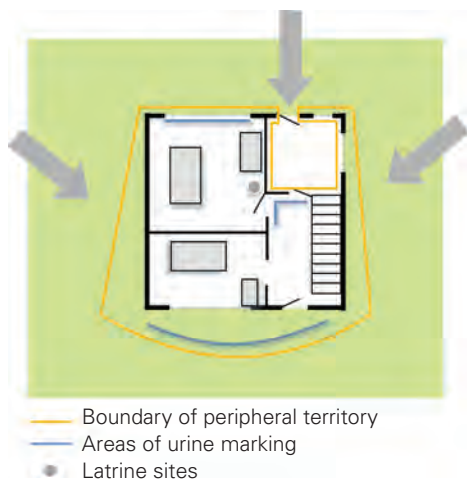
For a number of reasons some cats are unable to maintain any significant territory beyond the four walls of the owner's home. This can be due to debilitation, fear when accessing the outdoor environment or more commonly because the cat is kept indoors. Cats that spend all of their time indoors and see or smell outdoor cats, are unable to successfully use scent marks to maintain a sufficient boundary around the home; they may use visual displays and staring eye contact to deter cats that approach the house or spraying and aggressive posturing within the home, typically near external doors and windows. However, scent marking behaviours are non-functional because the odour signals that are deposited are not detectable by cats outside the home. They can have no effect on territorial maintenance.

With areas of the home being overlooked from outside, resident cats are vulnerable to threats such as staring eye contact and aggressive postures. This may make access

Indoor cats and those that become "housebound" through competition with other cats may mark around the inside of the home in order to maintain territorial integrity



Non-resident cats may enter the home, further reducing the space available to the resident cat, and potentially competing with it for food



to certain parts of the home unreliable because of the risk of a distressing confrontation, albeit through a window.

Uncertainty about access to feeding, resting and latrine resources creates significant stress and may lead to increased competition with other resident cats, if there are any, and a higher probability of occasional spray marking items such as electrical equipment or items such as bags that are brought into the home, because these may emit or carry odours that are disturbing to the cat.

Once a high density of spray marks have contaminated

this environment, the home may no longer be perceived as entirely safe by other resident cats. This can raise tension, anxiety and the probability of conflict still further. The owner may see that the resident cat will be hesitant in its movements into and around the garden, as well as in parts of the house that are overlooked from outside.

### ***Invasion of the home by non-resident cats***

In situations where outdoor access is through a cat door, non-resident cats may enter the home for a number of reasons, including:

- For social interaction with a resident cat with which it prefers social contact.
- In order to gain a share of food or other resources, in the knowledge that this may involve competition with a resident cat.
- To explore a location that has apparently not been claimed by another cat.

This last situation can arise when a resident cat is too nervous or intimidated to make a proper attempt to maintain territorial marks around the house.

This will lead to some observable changes:

- Spray around entry points and the areas of the house that the non-resident cat has explored. These may be deposited by the resident or non-resident cat.
- The resident cat may show signs of anxiety when accessing areas of its own home (inhibition, hesitancy, hypervigilance, ease of startling).

Resident cats may retreat farther into the home, especially to the upper floors or the ground floor rooms farthest from the cat door.

## **Potential patterns seen in elimination problems**

- Intermittent use of a single latrine location in the home: unreliable availability of latrines outside the house, or intimidation by non-resident cats.
- Use of a non-litter-tray latrine site for urine, while still using a litter tray for faeces (or vice versa): litter tray aversion due to inappropriate litter/litter tray/location or cleaning, or excessive use by several cats.
- Regularly shifting pattern of urination and defaecation between certain preferred sites in the home, with different locations used at different times: anxiety over access as the cat is often disturbed whilst eliminating.
- Intermittent outbreaks of urination in multiple sites around the home: lower urinary tract disease such as Feline Interstitial/Idiopathic Cystitis (FIC), especially if the cat cries or urinates whilst standing.

### Improving the desirability of litter trays

- Place in location that provides the cat with privacy.
- Use a deep-sided tray, filled to a depth of at least 25 mm with a suitable litter. Match the size of the tray to the size of the cat: 1.5 body lengths would be a good guideline for the long dimension of a tray.
- Use odourless mineral-based litter (not wood pulp/chip based or scented).
- Faeces and urine should be removed twice daily, but without using chemicals to clean the tray.
- Locate the tray away from areas of noise, disturbance and activity.
- Preferably provide one litter tray per cat/faction plus one additional tray.
- Outdoor latrines can be constructed by digging a 60 cm deep hole that is filled with soft sand. These do need to be regularly scooped to remove faeces, but are essentially self-cleaning.

For the indoor-only cat, there is at least no possibility of other cats entering the home. There is still the possibility that odours may be transported into the house if neighbouring cats regularly scent mark around the garden and doorways out of the house. These odours can be brought into the home by drafts of air or on the owner's clothes, shoes and baggage. Indoor cats are also vulnerable to visual threats from non-resident cats lurking in the grounds of the house.

Urine marking may occur inside the home because multi-cat households of indoor cats may create overpopulation that is very stressful for otherwise quite sociable cats, especially given that resources may be relatively scarce or poorly distributed.

### B) Inappropriate elimination

The cat has certain requirements for a toilet location: privacy, suitable substrate (litter, sand, dry soil etc), and ease and reliability of access. Unlike dogs, cats do not use communal latrines and they also prefer to use separate latrines for urine and faeces. Inappropriate elimination that results from anxiety arises from reduced certainty of access to an existing, suitable latrine location. Primarily, this stems from the same social and territorial concerns that underlie indoor marking and aggression, which are often also present. The situation can be made worse in winter, when wet or icy weather makes soil harder to dig and cats may have to compete for remaining outdoor sites.

Common causes of house-soiling are therefore:

- Shared litter trays
- Poor litter tray design
- Unsuitable litter type
- Inappropriate litter tray location: lack of privacy etc
- Competition for latrines
- Poorly maintained litter trays

### C) Aggression

Cats use a range of distance maintaining behaviours to avoid conflict. When conflict does arise, it usually begins with distant threats such as staring eye contact and vocalisations. In these situations, cats tend to move very slowly in order to avoid triggering chasing behaviour. The relatively inhibited nature of aggressive behaviour in cats means that it tends to get overlooked. Staring, hissing, spitting, growling and other significant threat behaviours go by unnoticed by owners or are passed off as part of play. Observing and recording these behaviours is key to assessing the nature of the problem and response to treatment.

More intensely aggressive behaviour such as postural displays (piloerection, back arching etc) chasing and actual physical fighting are much less frequent and so it is hard to use the future recurrence of these behaviours as an indication of the success or failure of treatment.

#### Aggression between cats

Inter-cat aggression is best assessed by creating an

interaction diagram and then detailing this with examples and frequencies of all low and high-level aggressive behaviour that have been witnessed. If outdoor access occurs, it may be useful to extend this to interactions with non-resident cats where possible. Information about hesitancy when cats approach resources such as feeding bowls can be useful to illustrate to owners the effects of anxiety.

Aggression between cats is generally concerned with competition over resources or territory, or emotional problems such as fear of other cats. In some cases of spraying where there is social stress between resident cats, it is not apparent to the owner that this is also accompanied by more overtly confrontational behaviour. The most frequent expressions of aggressive behaviour, such as staring and low-level postural threats, are often unnoticed by cat owners. This tends to lead owners to make a false underestimation of the tension between resident cats. Owners will often cite the cats' sharing of food bowls and resting places as a sign that the relationship between cats is good when, in fact, the cats never show affiliative behaviour, are generally hostile towards each other and have even injured each other during fights. Therefore, various manifestations of aggressive, fearful and anxious behaviour in cats should be explained to the owner.

### Aggression towards people

Where it occurs, aggression towards people is usually due to fear or anxiety. Conflict with owners over food or possession of objects or space is unlikely given the social system in cats.

Ask the owner to bring a map of his home



Cats will primarily choose to escape from threat wherever possible, freezing when it is unclear how this may be achieved and then fighting when this is necessary to gain an opportunity to make an escape. Aggressive attacks on people are therefore rare because, in most situations, the cat is able to escape.

Learning or a background of emotional tension is necessary to create the conditions for aggression towards people and there are some general situations in which this may occur:

- Attempts to handle or approach cats that startle them when they are in a state of high arousal and conflict with another cat. A typical example is when the cat is being threatened by a non-resident cat outside the window and the owner approaches to try to comfort the resident cat.

### Warning signs of aggression

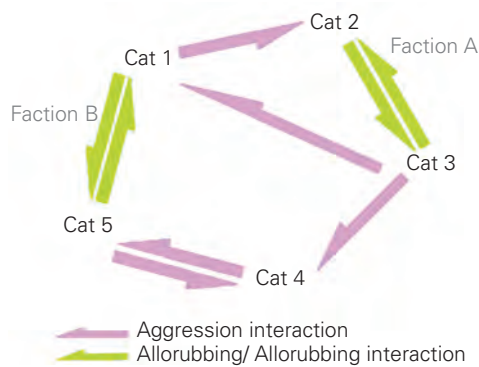
Clients must be made aware of warning signs that indicate that the cat is likely to behave aggressively. This will enable them to avoid injury and unintentional intimidation or provocation of the cat.

Important warning signs include:

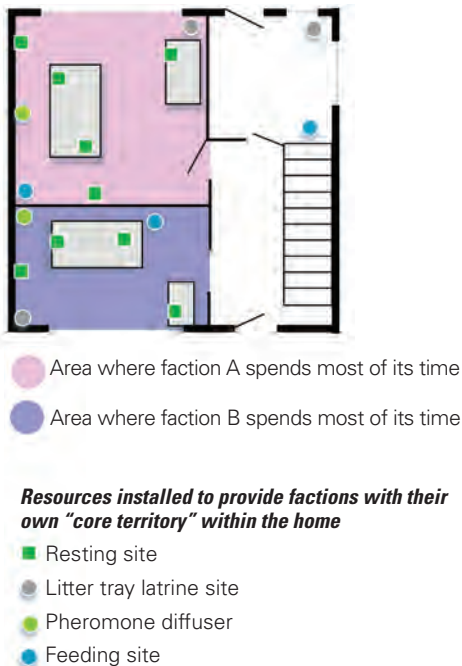
- Tail twitching
- Flattening of the ears
- Stiffening of the shoulders and legs
- Pupillary dilation
- Hissing and spitting

Owners must not attempt to soothe or handle the cat when it is showing this behaviour. Cats that are frozen in a self-defensive crouch may be close to launching an attack if they are provoked. Owners should look away from the cat and slowly move away if they feel threatened.

**A.** An interaction diagram visually clarifies the relationships between cats sharing a household, and can identify whether factions exist



**B.** To reduce competition between factions and individuals within the home resources should be distributed according to information gained from the interaction diagram



- Repeated attempts to restrain, corner or handle fearful cats. This overcomes the cat's ability to put into effect its primary species specific defence reaction of escape.

In the first situation, the cat may cause very serious physical damage to the person and may retain a memory of the incident that causes further serious attacks in the future. This underlines the importance of dealing with all aspects of a behaviour problem to reduce anxiety and provide the cat with a safe and reliable environment.

In the second situation, the cat may learn to use aggression rather than avoidance when encountering people. Attacks can be serious but in most cases merely involve threatening behaviour designed to force the person to retreat.

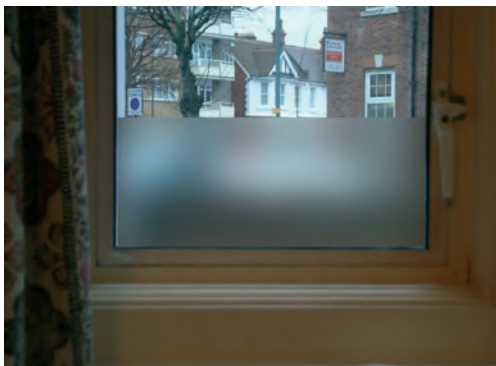
Providing better opportunities for escape and increasing interpersonal distance allows the cat to re-engage an avoiding rather than a confrontational strategy. Educating owners to avoid handling cats when they are fearful or anxious and aroused, can also help to resolve these problems.

#### 4/ A general approach to investigating and treating feline behavioural problems

The first step is to gather basic information about the problem, which is best summarised in the form of diagrams. Firstly there is the interaction diagram, which identifies the forms of social behaviour between pairs of cats and clarifies whether there are any factions in the group (see example).

In multiple cat households, it is important to identify whether there is any tension between the resident cats that may be a source of problems. This is easily done by examining the social behaviour between the cats. Cats that are part of a social group will regularly rub against each other, groom each other and show "tail up" greeting behaviour and trilling when they meet after a period of separation. They will not generally hiss, spit at, or chase each other. The owner should be asked to identify those

It is important to strengthen the perceived boundary of the home by using glass etch spray to block the view from certain windows to block the view from certain windows



© Jon Bowen

cats that groom, rub against and greet each other and those which regularly threaten each other.

So a diagram can indicate whether there are factions within the household. In the example on page 37 it is clear that within the group of five cats there are two pairs and a single solitary cat. Thus any factions can be identified.

Following from this, it is possible to make a diagram indicating where these factions spend most of their time

to determine where resources should be placed and how to use pheromone diffusers.

Treatment of problems involves general environmental changes that are designed to give the cat a more predictable and controllable environment. This allows cats to return to normal patterns of behaviour and activity. Specific interventions are also necessary. Urine must always be thoroughly cleaned from spray marked and inappropriate latrine sites in order to reduce the probability of re-use of these locations.

For cats that live mainly indoors or whose home has been invaded by non-resident cats, it may be necessary to install an electronic cat door with a coded transponder or magnet that permits the entry of resident cats only. For cats that spray mark and display aggression or fear of cats that approach close to the house, it is also important to strengthen the perceived boundary of the home by using glass etch spray to block the view from certain windows and to make the cat door completely opaque. It is also often helpful to clean areas around external doors to remove scent marks that may have been left there by non-resident cats.

The need for environmental enrichment tends to focus on inside the home, but it is equally important to provide additional clawing, scent marking and latrine locations around the edge of the garden.

In cases of aggression between cats sharing a home, it is important to try to provide a general excess of resources, with these being distributed around areas where the cats are most likely to use them, so that the cats can avoid interaction and conflict. Cats should also be provided with safe access to high perches and resting places, as well as boxes and other place to hide at floor level. This enables the cat to maintain a greater interpersonal distance and to engage in conflict avoidance. Information on re-introduction is provided elsewhere in this edition. ■

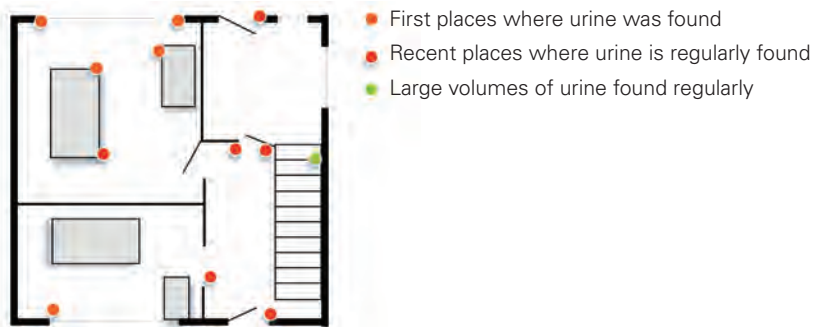
### Basic information needed to determine potential causes and solutions for indoor marking, elimination and inter-cat aggression problems

- Information about resident cats: age, gender (+neutering status), duration of ownership, health status (including blood and urine tests where appropriate), familial relationship with other cats in household, method of introduction to the home.
- Diagram of interactions between cats: to identify social relationships and factions.
- Diagram of the home: resting, feeding and litter tray location as well as locations where factions spend their time and places where urine or faeces have been found (other than in the litter tray). Diagram should also show where urine or faeces were first found, and how this has progressed over time.

The owner records information about urine in the home:

- Where? / How often? / Volume?

In this case spraying started around windows areas, progressed to inside the house and there is a single site of inappropriate urinary elimination under the stairs







## 4. Reducing and preventing anxiety in cats

### > Summary

Anxiety in cats can be caused by a number of factors including, but not limited to, the social environment and relationship with conspecifics, the personality of each individual cat within the household, the physical environment and distribution of resources, the ability to engage in species typical behaviours, owner behaviour, interaction and expectations, other animals in the environment and the pet's ability to control its situation. Heidenberger (1997) examined housing conditions and behavioural problems of indoor cats as assessed by their owners and found that 54% exhibited problems that their owners would like to change and 16.7% had symptoms of anxiety. In all situations, a good physical and medical examination is necessary to diagnose and treat any medical disorders that may be contributory.

### 1/ Social Environment

The social ethology of cats is quite variable, ranging from a solitary life style to group living in what are known as colonies. Early studies of free-roaming cats proposed that cats will often live together when there is an abundance of food, for example when someone feeds cats in a park, in a dairy barn or near a fishing dock. In these examples, the cats will congregate around the food source. Within this colony of cats, some research has also indicated that cats will form attachments with preferred associates while actively avoiding other cats within the group (Crowell-Davis, 2004). In feral cat groups, the individual attachments appear to be between female cats, their offspring and related females (sisters, aunts and mother). Group members appear to recognise one another and react aggressively to non-group members. The possession of appropriate feline social skills is likely, dependent on early experiences with other members of their own species. Cats that are adopted as kittens and raised as only cats may not have learned the social skills necessary to live amicably with other cats and may exhibit unwanted

responses such as aggression or anxiety and fear of other cats. Integral to all social situations is the ability of each individual cat to leave if the social situation is not to their liking, something that is not usually possible in companion cat homes.

Taking the varied social ability of cats into consideration when arranging households may help reduce or prevent stress or anxiety. Adopting related female cats or littermates might increase bonding and harmony within the home. Because social bonds are often between pairs of cats, when one member of the pair leaves the home due to illness or death it may not be prudent to rush to replace that individual.

### 2/ Personality of the cat and its effect on the development of anxiety

Each individual cat usually has a distinct temperament or personality that is integral to how it interacts with its

environment, the people and other animals within that environment and to developing its own behavioural style. The early environment of the kitten can have a strong influence on later behaviour. Early handling of kittens influences later friendliness to humans (Karsh, 1984) and is an important factor in the cat-human relationship and formation of a strong bond. The sensitive period for socialisation of a cat is thought to occur between 2-7 weeks of age. Kittens that were handled for as little as one hour a day benefited in later associations with humans. Some feral kittens that were not handled or had no human contact prior to 7 weeks could not be held for a minute when tested at one year of age. However, increasing the number of handlers may reduce stress and produce cats with a bold temperament (Lowe & Bradshaw, 2001).

Certain aspects of temperament are probably inherited while others are likely to have been influenced by early experiences, both positive and negative. Studies done in the 1980's attempted to identify personality types (Karsh & Turner, 1988. Karsh, 1984) often using terms that could be considered anthropomorphic such as confident and sociable or timid and shy. Individual variations in personality and temperament are likely to affect responses to changes in the environment and may determine whether an individual animal responds with anxiety. Some animals may show low levels of anxiety or

behavioural inhibition, such as hiding and escape, when they encounter environmental changes, other cats or new pets, visitors or noises for example. Other cats may be less able to cope and perhaps more prone to hiding, behavioural inhibition and escape behaviour, and may show other signs associated with distress (anorexia, over-grooming, changes in sleep etc.) when faced with changes or new or unfamiliar things. For these cats, a lack of appropriate outlets for hiding, escape and easy access to resources may exacerbate innate tendencies toward anxious responses and create tension and potential problems based on their temperaments. Temperaments can often be determined by watching how each cat responds to new things such as the ringing of the doorbell and entry of visitors into the home. Some cats may stay and greet people while others often hide or attempt to escape.

---

### A) Introducing additional cats

Levine (2005) studied 128 households with multiple cats and 124 households with a single cat and found that about 50% reported fighting when a new cat was introduced into the home. Neither the number of cats, nor their age or gender were associated with fighting that occurred when a new cat was brought into the home.

---

Create a separate area for the new cat



Ongoing fighting was associated with aggressive or unfriendly behaviour at the first meeting (e.g. scratching and biting) and outdoor access. It was also noted that the resident cats were more likely to engage in hissing and scratching or fleeing and hiding than the new cat, which is probably indicative of a fearful response. It was also noted that the resident cat was more likely to stare at the new cat, perhaps indicative of a bolder, assertive temperament. It is useful to consider each individual cat's temperament and past history of anxiety-based responses such as hiding, behavioural inhibition, etc. when adding new cats to the home. Cats with a past history of anxiety or hiding and escape may find a new cat intimidating especially if that cat is very assertive. Also, resident cats that are very assertive may harass a new addition.

When introducing additional cats to the home, certain techniques may help to smoothe the transition.

- Create a separate area for the new cat that is fully provisioned with food, water bowls and a litter tray. This is a temporary, transitional location through which the cat is introduced to the rest of the home.
- Place pheromone diffusers in both this room and in other parts of the home.
- Make any necessary alterations to the home so that resident cats have easy access to the required number of litter trays, resting areas, food and water bowls, scratching posts and climbing towers.
- Identify favoured food treats for resident cats and, if possible, for the new cat.
- When the new cat arrives, it should be placed in the transition area and not allowed visual access to the other resident cat(s).
- Using a towel or cloth, rub first the resident cat and then the new cat on their body and face to allow for

Rub the two cats with the same towel and leave it in the room



Add additional climbing towers, scratching areas, etc.

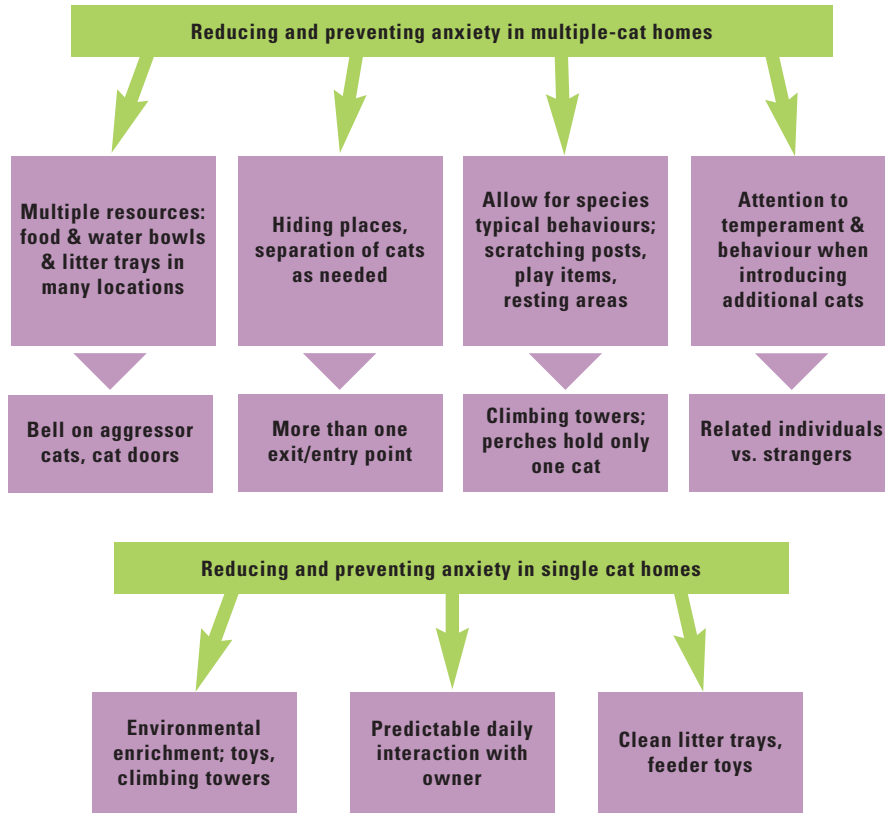


transfer of scent. Place one towel in each area after both cats have been rubbed.

- Once the new cat is comfortable in its space, it should be allowed to explore the rest of the home undisturbed whilst the resident cats are confined.
- After a week or so, if no overt aggression (growling, attempts to fight under the door) has occurred at the door where the new cat resides, short visual introductions may be attempted. At this point, do not allow physical contact; the cats should be contained in some manner (in crates, on harnesses/leashes; behind

Make short visual introductions. Put the new cat in a crate and try to provide the cat with enjoyable activities





doors with windows) but allowed to see each other. Try to provide the cats with an enjoyable activity such as play or eating a delectable food reward.

- Perform these visual introductions 2-3 times daily until all cats appear relaxed and there is no aggressive posturing.
- If signs of aggression occur (hissing, growling, swatting) then perhaps the cats are too close and increasing the distance may allow each cat to remain calm.
- If there are no signs of aggression, the cats can be allowed short periods of supervised contact with owners nearby to remove the cats at any sign of aggression such as hissing, growling, stalking, staring or chasing.
- Care should be observed and owners cautioned to progress slowly. Rushing introductions can result in aggressive responses which may make resolution and integration of the cats more difficult.

## B) Moving house

Cats who have shown anxiety at other types of changes may find moving to a new home extremely stressful. Prior to moving, attention to certain details may make the move easier for the cat. On the day that the household will be moved, the cat should be confined in a secure location with food, water and a litter box to prevent escape. Once all the possessions are in the new location, the cat can be transported using a cat carrier or basket to the new location where a room has been provisioned with food and water bowls, sleeping area and a litter box. The cat should be allowed to spend 1-3 days in this location so that it feels comfortable and relaxed. Then slow exploration of the home can be attempted with return to the secure area for feeding and resting. For some cats the use of pheromone diffusers may help ease the transition.

### C) Feline body postures

Cats use body postures to communicate information about their underlying emotional state and potential behavioural responses both to other cats and to humans. A cat will usually carry its tail high and upright over its back and ears erect when greeting, investigating or even when frustrated, while a relaxed cat usually has a hanging tail with the ears forward (Haupt, 2005).

An aggressive cat may have its head down, its tail away from the body, possibly twitching quickly back and forth, ears with their openings pointing to the side. An inhibited cat may crouch and perhaps roll over with ears back. A frightened cat will crouch, may hiss and will flatten its ears to its head. An extremely fearful cat may arch its back, piloerect its hair, hold its tail straight up, flatten its ears and may become aggressive if cornered.

It is important to understand and explain to owners the meaning of body postures associated with relaxation, stress, fear and anxiety because this will help them realise when their companion cats may be suffering. A relaxed cat will lie on its side or back, have slow respiration, legs and tail extended and relaxed, eyes closed or half open and will not vocalise. A cat with flexed legs but a slack tail and its head down or alert is also likely to be relaxed. A tense cat may lie down in a ventral position (on its belly), with its eyes open and its ears partially back and its tail tip may twitch slowly. As the cat becomes increasingly tense, the tail may move closer to

A cat will usually carry its tail high and over its back and ears erect when greeting



An extremely fearful cat may arch its back, piloerect the hair, hold its tail straight up and flatten its ears



the body, the eyes may widen, the pupils may dilate and there may be meowing vocalisation. The more fearful and anxious the cat becomes, the more the rate of respiration will increase, the ears may be flattened to the head and the cat may tremble and meow plaintively.

Certain physical symptoms may also be anxiety-based such as changes in grooming behaviour, certain alopecia conditions, hyperesthesia, interstitial cystitis and appetite changes. These conditions may not respond completely to medical treatment if contributory anxiety components are not addressed.

### 3/ The role of the physical environment and distribution of resources in the prevention of anxiety

Free ranging cats spend 40% of their time sleeping, 20% resting, 15% grooming, 14-40% hunting, 3% travelling and 2% feeding (Beaver, 2003). In the United States, cats are housed primarily indoors and therefore do not usually have to hunt or travel any great distances and their behaviour may adapt to reflect their present environment. In the UK, only about 10% of cats are thought to live totally indoors (Neville, 2004). Heidenberger (1997) found significant correlations between several housing factors

and the existence of behaviour problems. Cats that lived in groups of 2-3 exhibited problems more often than cats kept in other group sizes and cats that were allowed outside only seldom or in good weather also were more likely to show problem behaviour as reported by their owners.

---

### A) Dispersal of resources

Limited evidence suggests that cats do not share space equally within multiple-cat households (Bernstein & Strack, 1993) with some cats going into all areas and others only occupying small areas of the space available to them. This may be inherent not only in the social structure of the colony but also in how cats utilise and control territory. Because not all cats appear to utilise the space available to them, either due to choice or to social constraints, the dispersal of necessary items may play a critical role in creating or alleviating stress and anxiety. Creating an environment where food bowls (one per cat), water bowls and litter boxes are readily available in a variety of locations is essential. In addition, dividing the allotted food into 2-4 portions that can be hidden in various locations will allow for foraging and perhaps stimulate movement and create a more complex and novel environment for the cats. Food can also be provided in feeder toys that require manipulation to dispense the food and/or treats. Care must be exercised to provide enough food throughout the environment to be sure all cats have adequate daily nutritional intake.

---

### B) Resting areas

To provide for the needs of indoor cats or for cats that spend most of their time indoors, the cat owner should strive to provide each cat with security, variation, novelty and complexity in its environment. The cat should also be given the ability to control its environment and activities and to achieve its objectives. Some cats appear to prefer to rest on elevated places (Heidenberger, 1997) and these should be provided in various locations. These can be cat trees, climbing towers, window perches, bookcases, beds and shelving. The removal of breakable items from these areas will allow access without upsetting the household. Placing beds, pieces of fleece or blankets may encourage animals to seek out these places for resting. In most

cases, the area should preferably hold only one cat to avoid conflicts. Exposure to natural light and windows appears to be desirable, are enjoyed by many cats and may reduce stress (McCobb, 2005). Catwalks can be created to allow elevated access to various home locations. Moving beds on a regular basis provides a changing environment and stimulation that many cats may enjoy. Individual cats may have preferred spots or time-share them with other cats.

---

### C) Toileting areas

Providing appropriate toileting areas for indoor cats is essential. The litter trays should be appropriately sized and research indicates that cats prefer larger areas for elimination than what is usually provided by standard purchased litter trays. This can often be accomplished by using large size plastic storage boxes. Location and number of litter trays is also an important factor. If due to social constraints all cats do not have access to the entire environment in which they live, then litter trays must be allocated throughout the home, taking into consideration where individual cats spend their time. If at all possible, the location should have more than one entrance/exit to prevent cats from being trapped, either by other animals or by humans, while attempting to eliminate.

The number of litter trays provided should correspond to one per cat plus one additional tray. Since cats are extremely fastidious and clean, they require a clean toileting area. Litter trays should be scooped twice daily and emptied and washed weekly with a mild soapy solution and rinsed thoroughly. In some cases, it may be appropriate to provide different choices of litter trays and litter materials to ascertain what the cat prefers.

Cats that go outdoors still may come inside to eliminate, eat and sleep. Their needs for diversity and novelty should also be met and their presence taken into consideration when arranging resources for the indoor cats.

---

## 4/ Ability to engage in species typical behaviour

While free-ranging cats spend a great deal of time resting, hunting and foraging provide additional stimulation.

### Maximising the use of a scratching post

- Place scratching posts in areas where cats spend their time
- Use scratching posts made of materials that shred and tear
- In a home with multiple cats, have multiple scratching posts in many locations
- It is possible to combine scratching posts and climbing/resting towers.

Companion cats need activities that are stimulating and active to remain both physically and behaviourally healthy. For example, play and activity feeders may be used to simulate hunting behaviour. Acceptable materials for scratching and play must also be provided.

limbs and cardboard should be provided in multiple locations within the home. In some cases, enhancing the scratching post with catnip will encourage use.

#### A) Scratching and marking with claws

Scratching is a normal behaviour that includes marking, stretching and conditioning of the claws but often causes owner distress if it occurs in an unwanted location. A cat will tend to use a scratching location when they wake up and usually near where they spend their time. Posts must be situated where the cats are likely to use them. Materials provided in out-of-the-way locations will not often be utilised, resulting in the cat scratching owner possessions in the area where the cat most commonly resides. Cats appear to prefer material that shreds and tears for scratching. Scratching posts of sisal are often preferred but additional materials including carpet, tree

#### B) Providing appropriate play opportunities

Play can be an integral part of enrichment and entertainment for a cat. The types of toys provided and the frequency of rotation may influence their desirability to the cat. Cats appear to prefer a variety of toys with differing characteristics of size, material and movement. Toys that stimulate predatory responses and those that encourage play are preferred (Denenberg, 2003). Shorter rather than longer sessions appear to stimulate play and prevent lack of interest. Cats may quickly habituate to the characteristics of a toy during play and the intensity of the play may diminish, but switching to another toy after a short delay often will result in a resumption of uninhibited play (Hall *et al*, 2002). Owners should strive to offer not only enticing toys but also multiple play

Special interactive toys are available that encourage facial and flank marking behaviours



Playful activities





sessions with their cats. Often picking up toys and rotating them every few days provides more interest and playful activity. Offering paper bags and boxes also provides entertainment and stimulation for many cats.

Some cats find visual stimulation interesting and will watch cat videos on television. Other cats find sitting in the window and watching birds come to a bird feeder to be quite engaging. Window perches should be provided in multiple areas to avoid one cat monopolising the perch. In some cats, visualisation of outdoor areas where cats are present can increase stress and anxiety and may result in urine spraying. For those cats, blocking visual access out of windows may be more desirable.

## 5/ Owner behaviour and interactions

All animals prefer consistent interactions and predictable routines which help the animal feel in control and less anxious. Cats need and want contact with their owners, but what they find enjoyable may differ from what is provided. Cats usually prefer short, but frequent contact in the form of brief petting and grooming and social interaction such as being talked to. Many cats also want and desire interactive play time with their owners. If these activities are provided at regular times nearly daily, most cats will be calm and relaxed.

At times a cat may perform behaviours that the owner finds objectionable. Yelling, physical reprimands and isolation are ineffective in changing behaviour and can damage the pet-owner relationship. Furthermore, punishment does not provide the pet with any information on how to avoid it in the future and what behaviour is preferred. The first step in changing an undesirable behaviour is an understanding of why it might be taking place. Cats that scratch furniture may not have an appropriate scratching post or the post may not be in a preferred location. Making scratching posts more accessible and attractive may be the answer. Cats that do not use their litter tray may find the location, the type of litter or the cleanliness of the box to be a problem. The installation of more litter trays and more frequent cleaning of the trays may help to stop the unwanted soiling. It is important to note that cats that vocalise excessively may be expressing dissatisfaction with the general provision for their needs at times other than during the actual vocalisation. Spending additional time meeting the social,

play and grooming needs of a cat will often prevent or stop unwanted behaviours.

Creating sociable cats requires intervention. Cat owners should try to handle kittens daily and expose them to as many stimulating and novel things and people as possible. Play should be controlled by the owner with toys that are fun and encourage play without directing harmful actions toward people.

## 6/ Other animals in the environment

Creating harmony in the home when there are multiple cats or other pets can be challenging. Although cats have social relationships they may not choose to associate with all members of the household. As mentioned earlier, the distribution of resources is critical as are hiding places and escape areas. If cats do not get along, a number of strategies can help promote a more harmonious home.

- Creating multiple core areas that have food and water bowls, litter boxes, scratching posts and resting areas.
- Enforced separation using doors, gates and other barriers to prevent fighting.
- An approved cat collar with a large bell on the aggressor cat to warn the victim(s) of his/her presence so that they can escape.
- Electronic cat doors are available which are activated by a collar worn only by the victim so that they can escape into, or out from, a room but the aggressor cannot follow. They are easily available and reasonably priced.
- Programmed introductions using food rewards and supervision so that the cats learn to associate the presence of the other cat with pleasant things.
- Pheromone diffusers.

Plug pheromone diffusers



If the other animal is a dog, certain changes may help cats feel calmer in the home:

- Initial interactions must be monitored, preferably with the dog under control and on a leash for safety.
- Place litter boxes in areas inaccessible to the dog. The access for the cat should allow visualisation of entry to see if the dog is waiting nearby.
- Feeding the cat on an elevated surface may help prevent the dog from eating the cat food.
- Cat doors or gates on doorways may allow the cat entry but deny it to the dog. They also provide the cat with a means of escape to a safe area. ■

### Guidelines for bringing home an additional cat

- Create a transition area for the new cat.
- Place pheromone diffusers both in this room and in the other parts of the home.
- Make sure there are adequate resources throughout the home.
- Identify favoured food treats for resident cats and, if possible, for the new cat.
- Place the new cat in the transition area initially with no visual access to the other resident cat(s).
- Transfer scents between cats.
- Allow the new cat to explore the home while resident cats are confined.

### Actual Introductions

- Start with visual introductions, but no physical contact.
- Use restraint or containment such as crates, harnesses/leashes; behind doors with windows.
- Provide the cats with an enjoyable activity: play or a food reward.
- Attempt visual introductions 2-3 times daily until all cats appear relaxed and there is no aggressive posturing.
- If there are signs of aggression (hissing, growling, swatting), the cats must be further apart or the session should be shorter.
- If there are no signs of aggression, the cats can be allowed short periods of supervised contact.
- Owners must be nearby to remove the cats at any sign of aggression such as hissing, growling, stalking, staring or chasing.
- Rushing introductions can result in aggressive responses which may make resolution and integration of the cats more difficult.





## 5. Psychopharmacology

### > Summary

During the last two decades, the options for treating pet behavioural disorders with psychoactive substances have increased dramatically. The reasons for this increase are twofold; on the one hand, ever-increasing understanding of behavioural neurophysiology and on the other, the performance of clinical trials that demonstrate the efficacy of these drugs in treating various aspects of animal behaviour, such as anxiety.

In this chapter, the five steps for the prescription of a psychoactive drug are detailed:

- 1/ Obtain a complete clinical and behavioural history
- 2/ Perform a medical examination of the patient
- 3/ Choose the most appropriate drug
- 4/ Inform owners appropriately and obtain their written consent to the use of the medication
- 5/ Perform a thorough treatment follow-up

### 1/ Neurophysiological aspects

Drugs used for the treatment of anxiety include active substances that act on the four neurotransmitters that seem to be most clearly involved in the control of this emotional state: serotonin, nor-adrenaline (nor-epinephrine), dopamine and GABA (Gamma-aminobutyric acid) (Stahl, 2000).

Serotonin, nor-adrenaline and dopamine constitute the main neurotransmitters of the diffuse modulating systems. These neuronal nuclei originate in the brain stem, from where they branch out profusely and influence the functions of most of the superior structures of the central nervous system. Rather than transmit detailed sensorial information or trigger a specific behavioural

pattern, these systems perform regulatory functions that affect a significant number of neurones in the central nervous system. As a result, the serotonin, nor-adrenaline and dopamine systems are involved in the modulation of "arousal", learning and the control of emotions such as fear or aggressiveness (Bear, 1998).

GABA is considered to be the principle and most common inhibitory neurotransmitter in the central nervous system. GABA receptors are abundant in the cerebral cortex and the structures of the limbic system, especially the amygdala which plays a crucial role in the regulation of responses to fear and aggressiveness (Stahl, 2000).

It is more important to highlight the numerous interactions between the four neurotransmitters in question rather than their independent individual effects (Mertens, 1998).

## The efficacy of psychoactive drugs in behavioural medicine

The assessment of the efficacy of psychoactive drugs in behavioural medicine is provided by two sources:

- Clinical evidence accumulated by behavioural specialists
- Controlled clinical trials

In this document the choice and later recommendation for use of a particular psychoactive drug are based on at least one clinical trial that demonstrates its efficacy or on the clinical experience accumulated by several behavioural medicine specialists. However, it should be kept in mind that well-designed clinical studies are always preferred. Prescribers should always keep up to date with current references for drug selection, dose rates and reported adverse effects.

## 2/ Classification of the most common psychoactive drugs

Psychoactive drugs can be grouped according to very diverse criteria, ranging from their chemical structure or pharmacological action to their therapeutic use. One of the most widely used classifications of psychoactive drugs combines clinical application in human medicine with references to the mode of action or structure of the drug. For example, clomipramine belongs to the category of tricyclic antidepressants, in clear reference to its chemical structure and its first application in the field of psychiatry. Although this classification is widely used, it can be a cause for confusion, especially for pet owners.

The reason is that, firstly, over the years, drugs such as antidepressants that were initially indicated for one purpose have been shown to be effective in the treatment of other psychiatric disorders, such as anxiety or compulsive-obsessive disorder. Secondly, in the field of behavioural medicine, many psychoactive drugs are used for purposes different from those specifically psychiatric. Fluoxetine, for example, is an antidepressant but it is commonly used in cats to treat aggressiveness or stress-related urine marking.

### A) Benzodiazepines

Benzodiazepines enhance the inhibitory effects of GABA. The effects of benzodiazepines on behaviour are dose-

dependent; low doses cause light sedation, medium doses produce anxiolytic effects and high doses cause hypnosis. Behaviour that has been inhibited by anxiety, such as exploration, appetite or consumption of water, will return to normal levels of expression under the effects of benzodiazepine drugs. In addition, these drugs possess an appetite-stimulating effect that can be very useful in the treatment of patients with anorexia (Landsberg, *et al.* 2003).

Two aspects of the mode of action of benzodiazepines limit their use in cats and justify the fact that these drugs are not considered as first-choice anxiolytics by specialists in behavioural medicine; liver toxicity and its potential for disinhibiting aggressiveness.

The literature mentions sporadic cases of idiopathic hepatic necrosis during the first 7 days of treatment with oral diazepam (Center, 1996). Although studies do not exist on the risk of other benzodiazepines, such as alprazolam or oxazepam, some authors believe that their different metabolism makes them safer alternatives than diazepam (Mertens, 1998. Landsberg, *et al.* 2003). Nonetheless, it is advisable to perform a liver function test in those patients to be treated with benzodiazepine before and during the week following the beginning of treatment. However, previous normal liver function results do not rule out the possibility of hepatic crisis and require close monitoring of the condition of the animal once the treatment has started. Along these lines, the presence of anorexia can be one of the first symptoms of hepatic necrosis and requires the immediate interruption of the treatment.

Benzodiazepines, especially at low doses, can disinhibit certain forms of aggressiveness. This effect has been

## Benzodiazepines

### Advantages

- Very fast acting drugs
- Pure antianxiety effect

### Disadvantages / Precautions

- Idiopathic hepatic necrosis (orally administered Diazepam)
- Paradoxical increase in aggression (especially at low doses)
- Tolerance may develop after long-term administration
- Contraindicated in pregnant or lactating females

observed, not only in animals, but also in humans and laboratory-tested rodents (Miczek & Fish, 2006).

Of all the drugs available for the treatment of anxiety, benzodiazepines are the fastest acting, although they also produce a high relapse rate when the treatment is withdrawn. In some trials, the rate of recidivism has been shown to be as high as approximately 90%. In any case, these drugs can cause physical dependence and, after treatment for more than one week, they must be withdrawn at a rate of 25% of the initial dose each week (Eckstein & Hart, 1998).

## B) Azapirones

The only member of the azapirones that is available on the market is Buspirone. These drugs are partial 5HT<sub>1A</sub> serotonergic receptor agonists and, to a lesser degree,

## Azapirones

### Advantages

- Safety (Relatively low profile of side effects)

### Disadvantages

- Relatively long latency period (1-3 weeks)
- Potential for paradoxical increase in aggression

D<sub>2</sub> dopaminergic receptor antagonists.

Buspirone can be classified as a mild anxiolytic and is indicated in the treatment of a variety of feline behavioural disorders associated with stress, such as urine marking, defensive aggressiveness or compulsive disorders. In addition, this drug is very safe, produces low levels of sedation in the patient and is associated with a lower relapse rate than benzodiazepines after withdrawal of treatment (Eckstein & Hart, 1998. Landsberg, *et al.* 2003).

However, the clinical experience of several specialists in behavioural medicine does not recommend buspirone as a first choice anxiolytic in cats. As with the benzodiazepines, there is the potential to increase aggressiveness in certain animals. Insofar as food ingestion control is concerned, buspirone does not possess appetite-stimulating effects.

Some cats receiving buspirone are described by their owners as being more affectionate (Crowell-Davis, 2006a).

The latency period of buspirone is relatively long, between 1 and 3 weeks, before its therapeutic effects are visible.

## C) Tricyclic antidepressants

Tricyclic antidepressants are a group of psychoactive drugs whose main pharmacological action is the stimulation of serotonin turnover and nor-adrenaline turnover, although to a lesser degree, by blocking reuptake.

In addition, tricyclic antidepressants possess anticholinergic and antihistaminic effects as well as alpha-adrenergic blocking effects, which are significantly responsible for the adverse events that they can produce. These include sedation, urinary retention, constipation or tachycardia (Stahl, 2000. Landsberg, *et al.* 2003).

The tricyclic antidepressants most widely used in behavioural medicine are amitriptyline and clomipramine (Hart, 2005). Clomipramine is often described as a serotonin reuptake inhibitor (SRI) as it was the first commercially available molecule that produced a blocking ratio that was 5:1 in favour of serotonin vs. nor-adrenalin reuptake (Stryjer, 2005). It is, however, still chemically part of the tricyclic group and should not be

## Tricyclic antidepressants

### Advantages

- Relatively safe.
- Can be used in patients showing aggression.
- Some have analgesic properties (amitriptyline).
- Efficacy supported by some well-designed clinical trials (Clomipramine).

### Disadvantages

- More adverse effects than SSRI.
- Long latency period (2-6 weeks).

confused with the more modern selective serotonin reuptake inhibitors (SSRIs).

The pharmacological differences between the various active substances included in this category are associated with greater or lesser degree of action on each of the 5 pharmacological mechanisms described earlier. For example, amitriptyline possesses a relatively higher level of antihistaminic action, which translates to a higher sedating effect than occurs with other drugs, such as clomipramine.

Amitriptyline possesses an analgesic effect which, along with its anxiolytic properties, could be very interesting in the long-term treatment of refractory cases of feline interstitial/idiopathic cystitis (Hostutler *et al*, 2005).

Tricyclic antidepressants can take between 2 and 6 weeks to produce observable therapeutic effects.

## SSRI

### Advantages

- Very selective pharmacological action
- Can be used in patients showing aggression
- Efficacy supported by well-designed clinical trials (Fluoxetine)
- Can be administered every other day (Paroxetine)

### Disadvantages

- Long latency period (up to 6 weeks)

Therefore, they are not strongly indicated therapeutic agents for the fast control of an anxiety disorder.

## D) Selective serotonin reuptake inhibitors (SSRI)

From the biochemical standpoint, the principle function of this group of drugs is to enhance serotonergic activity by selective blockade of the reuptake of this neurotransmitter by the presynaptic neuron. When compared to tricyclic antidepressant agents, SSRIs are relatively free of pharmacological actions on other neurotransmitters, which significantly reduce their adverse effects profile.

Fluoxetine is probably the most widely-known substance in this category that is used in feline behavioural medicine, especially in the treatment of urine marking, aggressiveness and compulsive behaviour (Pryor *et al*, 2001; Hart *et al*, 2005).

Another of the drugs included in this group is paroxetine. This shares the same general indications and adverse effects with fluoxetine, although its mild anticholinergic activity may cause slight sedation, urinary retention, constipation and other gastrointestinal symptoms.

The therapeutic effects of selective serotonin reuptake inhibitors can take up to 6 weeks to appear. They are therefore not the best choice for the fast control of a clinical presentation of anxiety in cats.

## E) Monoamine Oxidase B inhibitors (MAOlb): Selegiline

Selegiline is an irreversible inhibitor of the MAO-B that has proven to be effective in the management of cognitive dysfunction in dogs (Heath, 2002; Landsberg, 2005). The clinical opinion of many behaviourists, especially from European countries, also supports the use of Selegiline in the treatment of a wide range of canine and feline behaviour disorders where fear or anxiety is involved (Horwitz, 2002).

The drug may take a few weeks to reach a full effect and should never be administered together with SSRI or tricyclic antidepressants. In case of shifting to a TCA or an SSRI, a 2-weeks resting period must be observed after selegiline is discontinued. Similarly, a 5-weeks resting period must be established when shifting from fluoxetine to selegiline. Selegiline should not be used together with the ectoparasiticide Amitraz, because of its potential MAO inhibiting properties (Crowell-Davis & Murray, 2006).

exert a marked effect on the behaviour of animals in general and of the cat in particular.

A pheromone is a volatile chemical substance that, once released by an animal, has the capacity to modify certain physiological and behavioural aspects of the individual that senses it.

The functions of pheromones include virtually all aspects associated with social behaviour and are species-specific. Pheromones are secreted by different parts of the body and can be sensed by the vomeronasal organ and the olfactory mucous membrane.

As regards the cat, the secretion of pheromones by the cutaneous glands of the face has undergone the most investigation and offers a great potential in a number of clinical applications. One, the fraction of the feline facial pheromone known as F3, appears to aid cats in distinguishing between familiar and unfamiliar locations and objects, and thereby to organise their territory and achieve and maintain a healthy emotional balance.

Some years ago, a synthetic analogue of F3 fraction was introduced to the market (Feliway®; CEVA Santé Animale). This product appears to produce behavioural effects that are similar to those of the natural pheromone. A number of studies suggest the efficacy of

## F) Additional therapies

### 1) Synthetic pheromones

Olfactory communication mediated by pheromones can

### Combination therapies

Combination treatments, in which two or more psychoactive drugs are administered concomitantly, have been well-established in the field of human psychiatry. However, this therapeutic option requires further investigation in feline behavioural medicine in order to evaluate its efficacy and safety.

One of the most common combination strategies in feline behavioural medicine is the use of a fast onset of action drug, like alprazolam, together with a slow action one, like fluoxetine (Crowell-Davis, 2006b). Alprazolam would provide a rapid and immediate control of symptoms during the initial period of treatment, whilst allowing time for the effects of fluoxetine to develop and offering a reduced risk of relapse once the medication is discontinued.

It should be remembered that the use of more than one drug acting on serotonin should be avoided, since that could cause the so called serotonin syndrome, characterised by mental changes, neuromuscular disorders and autonomic symptoms (Crowell-Davis & Murray, 2006b). Also, serotonin acting drugs should never be administered with selegiline.



**Pharmacological classification, dosage and most common adverse events of the psychoactive drugs indicated for the treatment of anxiety in cats**

Category	Active substance	Dose	Most common adverse events
Azapirones	Buspirone	0.5-1 mg/kg PO q12	Gastrointestinal symptoms (mild) Irritability
Benzodiazepines	Alprazolam	0.125-0.25 mg/kg PO q12	
	Clorazepate	0.02-0.4 mg/kg PO q12-24	
	Diazepam	0.2-0.4 mg/kg PO q12-24	Risk of hepatic necrosis (diazepam)
	Oxazepam	0.2-0.5 mg/kg PO q12-24	
MAO-B Inhibitors	Selegiline	0.5-1 mg/kg q24	Gastrointestinal symptoms
Reuptake Inhibitors Selective Serotonin	Paroxetine	0.25-0.5 mg/kg PO q24-48	Loss of appetite
	Fluoxetine	0.5-1 mg/kg PO q24	Constipation Urinary retention Sedation
Tricyclic antidepressants	Amitriptyline	0.5-1 mg/kg PO q12-24	Gastrointestinal symptoms
	Clomipramine	0.25-0.5 mg/kg PO q24	Constipation Urinary retention Heart conduction problems

this product in the treatment of conditions with an underlying stress component, such as urine marking, feline interstitial/idiopathic cystitis, transport stress, clinical handling or anorexia associated with stress caused by hospitalisation. The increase in the rate of behaviours such as food ingestion, exploration or play in cats exposed to pheromone suggests that the common mode of action of this substance is in fact to reduce the level of anxiety (Griffith *et al*, 2000. Hunthausen, 2000. Pageat & Gautier, 2003).

The synthetic analogue of F3 is available in two presentations that can be used independently or in combination; a spray for local application on certain areas of the surroundings and an electric vapouriser.

**2) Lactium**

Nutritional supplements such as the decapeptide Lactium® (tryptic hydrolysate of alpha-S1 casein) can also be used to treat anxiety problems (Miclo *et al*, 2001).

In preclinical tests on rats (Elevated-Plus maze test and Conditioned Defensive Burying test), Lactium® was as efficient in reducing anxiety signs as the reference anxiolytic drug diazepam, but without the classical side effects of benzodiazepines. There was no disinhibition of aggressiveness or impairment of memory (Schroeder *et al*, 2003).

Also, a statistically-significant positive effect on anxiety has been suggested in dogs and cats. Lactium acts chiefly

**How to use pheromones?**

- The installation of a vaporiser is probably the best way to apply the F3 feline synthetic pheromone within a household.
- The spray presentation works better for small places, like transport cages, or as a complement to the diffuser.
- Pheromones can be used alone or in combination with psychotropic medication.
- Feline pheromones do not affect the behaviour of people or other domestic animals, such as dogs or rabbits.

as a partial agonist of the GABA-B receptor, but an effect on serotonin and dopamine is also suspected (Béata *et al*, 2005).

---

### 3/ The five steps for the prescription of a psychoactive drug

---

#### A) Obtain a complete clinical history

Pharmacological therapy is only useful as an integral part of global treatment of the patient's anxiety disorder.

Only after obtaining a detailed description of the cat's behaviour, its environment and the factors that trigger the disorder can we: one, establish whether or not to use medication and two, choose between one active substance and another, as will be explained further on.

---

#### B) Perform a medical examination of the patient

Most psychopharmacological agents used in behavioural medicine offer an adequate safety profile. However, the danger presented by a drug does not only depend on its characteristics but also on the health condition of the patient receiving the treatment. Consequently, before administering any psychoactive drug, it is recommended to perform a medical examination of the patient which will include at least the following:

- A physical examination.
- A blood analysis including blood cell count and basic blood biochemistry.

The medical examination is not only indispensable to guarantee the safety of the drug but also to rule out medical difficulties that may cause behavioural changes. It is also important to consider the pharmacokinetics interactions of psychoactive drugs with other medications the animal may be receiving.

---

#### C) Choose the most appropriate drug

For many years, phenothiazines and synthetic progestins have been widely used in veterinary medicine. However, these active substances are relatively non-specific. Acepromazine, for example, is used to produce non-specific depressant effects on the central nervous system. Today, the essential objective of psychopharmacology is the use of drugs with modes of action that are appropriate for specific disorders.

In compliance with this premise, the choice of the correct psychoactive drug for the treatment of anxiety disorder should be based on the following points:

- Knowledge of the mode of action of the most widely used psychoactive substances and a clear understanding of the most common adverse events.
- An assessment of the symptoms presented by the patient and the severity of the disorder.

#### Symptomology and case severity

The symptoms presented by a particular patient are one of the essential criteria necessary when making the choice of which drug to use.

- In the presence of aggressiveness:  
If the animal behaves aggressively towards its owner, the administration of the drug may be simply non-viable.

If the animal behaves aggressively towards other cats or individuals not within the family, fluoxetine could be the first choice anxiolytic treatment. Further, fluoxetine seems to be effective in controlling impulsive and excessively reactive patients.

In any case, it is important to avoid the use of benzodiazepines and buspirone, since either of these drugs could increase aggressiveness, as mentioned earlier.

- In the presence of anorexia:  
Anorexia is potentially one of the most serious manifestations of anxiety in the cat, particularly due to the risk of onset of hepatic lipidosis.

The need for fast pharmacological intervention suggests the use of benzodiazepines as the first choice drug in cases of anorexia (Beaver, 2003a). Of this drug group, oxazepam is perhaps the safest and possesses the most significant appetite-stimulating effect.

- In the event of alterations in grooming behaviour (psychogenic alopecia):  
In general terms, drugs acting on serotonin are more highly recommended in the treatment of psychogenic alopecia in cats. Of these, clomipramine and fluoxetine are perhaps the most highly recommended in the treatment of compulsive behaviour in pets (Virga, 2003).
- In the event of inappropriate urination:  
The efficacy of fluoxetine and clomipramine has been assessed in clinical trials that demonstrate these to be the most appropriate options for a urine marking behavioural pattern associated with stress (Hart *et al*, 2005).

In cases of interstitial/idiopathic cystitis, amitriptyline appears to be the most appropriate therapeutic alternative but it is important to investigate all urological cases carefully before administering drugs from this class as they may increase urinary sphincter tone and thereby increase susceptibility to urinary outflow obstruction.

The choice of a specific drug does not depend solely on the pharmacological profile of the drug, but also on the detailed study of the characteristics of the patient.

---

## D) Inform the owner appropriately

Some owners may be reluctant to use psychoactive drugs to treat a behavioural problem in their pet. In part, this reluctance is due to deficiencies in the information they are given at the start of the treatment. It is therefore essential that the veterinarian fully informs the owner and resolves any concerns they may have before starting treatment.

Following are the four questions most frequently asked by owners faced with the possibility of administration of a psychoactive agent to their cat.

### 1) Am I drugging my pet?

No, psychoactive drugs are only to be used to treat abnormal behaviour or behaviour representing loss of capacity for autoregulation and never to suppress normal biological conduct (Beaver, 2003b).

Anxiety can be understood as a response of the organism with the purpose of guaranteeing the survival of the individual. The anxiety response is the result of the coordination of neurological and hormone mechanisms that involve numerous structures both within and without the central nervous system.

The difference between physiological and pathological anxiety is not well-defined in the field of behavioural medicine. However, in human psychiatry, clinical disorders associated with anxiety appear to relate to either an abnormally low threshold of activation for an anxious response or the inability of the patient to reduce anxiety once the triggering factor has gone (Cummings, 2003).

### 2) Are these substances safe?

As has been mentioned earlier, most psychoactive drugs can be used without endangering the health of the patient. However, it is recommendable to inform the owner of the adverse events and risks associated with the administration of the drug. As an additional precaution, written consent should be obtained. This is particularly important because a significant number of psychoactive substances used in behavioural medicine are products used in human medicine, the use of which is not explicitly approved or licensed in animals. Control of the use of drugs not specifically licensed for animals (extra label use) is subject to national regulation and veterinarians should be aware of the law relating to this issue in their country.

### 3) How do I administer the treatment to my cat?

Problems of administration of psychoactive drugs in cats are associated with two aspects; rejection by the animal and the difficulty in obtaining the drug in a presentation that is appropriate for the cat.

Oral administration of drugs can be extremely difficult, especially in patients that already manifest stress reactions.

*a) Intolerance to drug administration*

Oral administration of drugs is rejected by many cats, and this rejection is sometimes violent. First of all, the cat may not be accustomed to being handled, restrained or even picked up regardless of the issue of actually administering medication. It is important to remember that behavioural medicine treatments frequently require repeated oral administration of the drug, which may taste bitter or otherwise unpleasant. As a result, some animals may present relative tolerance during the first doses but develop significant aversion later that impedes all possibilities of administration.

It is important to bear in mind that we are speaking of patients already subjected to intense stress conditions, which may not only contribute to a more intense initial

rejection of drug administration but also that this rejection may increase as a result of the uncomfortable experience of having to take the drug.

In any event, it is much easier to accustom the cat to handling, restraint and oral administration of dummy medication in the form of a placebo if this is practiced preventively during the first few weeks of the cat's life. In fact, this is one of the exercises that form part of kitten education programmes performed between 7 and 13 weeks of life. It is also helpful for clients to rehearse handling and placebo administration for a period before actually giving the real medication, as this allows the cat and the owner to become used to the procedure gradually and without the added pressure of needing to deliver a dose.

**Tips for the owner**

- Try to associate the routine of giving the medication with positive experiences, like giving a preferred food, play or petting.
- Never try to "catch" the cat while eating or eliminating since that could create a food or a litterbox aversion.
- If the cat gets really anxious when medicated, clients should contact the veterinarian rather than proceed using greater restraint. Remember that, for some cats, oral dosing of anxiolytic medication is just not possible.

During the pre-treatment phase the cat is accustomed to the routine of being dosed with medication using a placebo



When treatment with the real drug begins the cat remains relaxed and easily handled



## Transdermal administration

Transdermal presentations of numerous drugs have appeared on the market in recent years. These include some of the most widely used psychoactive drugs. Transdermal administration is a very interesting alternative, especially in cats that do not tolerate oral administration well. However, the efficacy and safety of transdermal administration has not been well-established in pets. In this regard, two recent studies in cats suggest very limited and inconsistent absorption of amitriptyline, buspirone and fluoxetine using transdermal administration (Ciribassi *et al*, 2003; Mealey *et al*, 2004).

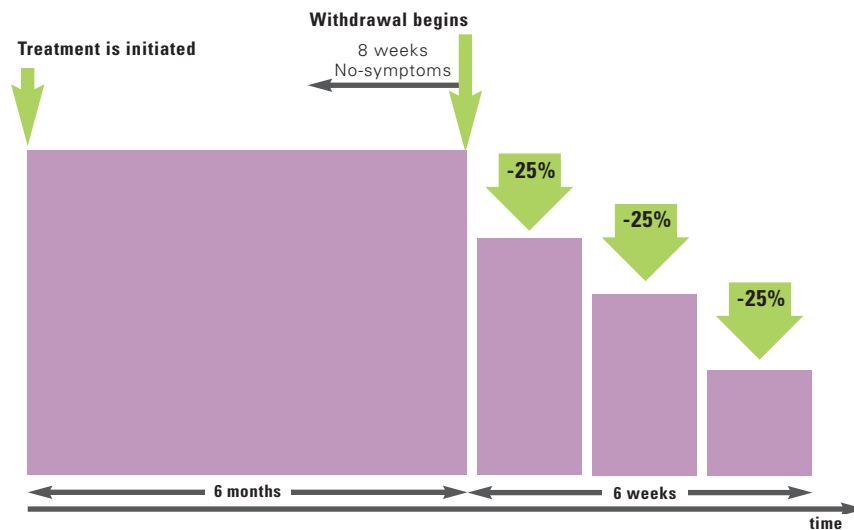
It is important that, from a young age, the cat associates physical handling and the administration of tablets with pleasant experiences such as play or receiving special treats.

Rejection of administration may not only be due to matters of handling but also to the taste of the drug. Many psychoactive drugs, such as buspirone and amitriptyline, have a very disagreeable taste that can be detected in very small quantities even when mixed with food. In addition, some cats are not accustomed to smells different from those of their usual food. It is therefore important that the kitten be accustomed from a young age to different foods that can later be used to camouflage the administration of a drug.

### b) Pharmacological presentation

As we have seen earlier, most anxiolytic drugs used in behavioural medicine are commercial presentations previously destined for human use. Although presentations may differ from one country to another, in many cases they are totally inadequate for use in cats. To give an example, fluoxetine is presented in syrup, whose excipient is often firmly rejected by the animal. Also, in some countries, especially in Europe, fluoxetine tablets or capsules are presented in a minimum 20 mg strength, which is much higher than the dose recommended for a cat and it is very difficult to accurately divide the tablets or capsules into suitable quantities. In many cases, the only alternative is to make a special order for the drug to

An example of withdrawal of a medication that has been administered for 6 months



be prepared in a suspension or encapsulated powder, specifically for each patient. The disadvantage of this is that such preparations only carry a guarantee of stability for a limited period of around 30 days.

It is important to inform the owners that the information contained in the patient information leaflets of many psychoactive drugs mentions indications, dosage and adverse effects related to the use of the drug in humans, which may have very little relation to the characteristics of the drug when used in pets.

#### **4) How long should the treatment last?**

Pharmacological treatments for behavioural disorders are usually relatively long. Some specialists in behavioural medicine recommend continuing pharmacological treatment at least two months after complete remission of the symptoms (See figure bottom page 60).

One of the most common pitfalls of the use of psychoactive drugs is the premature withdrawal of the medication. At the end of a period of treatment, it is always recommended to withdraw medication gradually. As a rule of the thumb, the withdrawal period should last as many weeks as

the duration of the treatment in months. During the withdrawal period, the drug should be tapered with 25% progressive dose reductions (See figure bottom page 60).

---

### **E) Perform treatment follow-up**

Once the treatment is started, it is important to monitor the progress of the case and the possible difficulties or adverse events that the owners may face as a result of treatment administration.

All patients receiving psychotropic medication should undergo a periodic medical examination (i.e. every 2 or 3 months) to assess potential drug side effects.

It is important to bear in mind that some psychoactive drugs commonly used in behavioural medicine, such as benzodiazepines, are drugs of abuse and can cause physical as well as psychological dependence in people. They may also be subject to specific legal control in certain countries. For example, in the UK diazepam is a schedule 4 controlled drug. Therefore, from a legal and public health viewpoint, it is important to keep a record in order to control dispensing at all times. ■



## 6. Myths and FAQs

### 1/ FAQs vet based

#### A) How can I reduce stress for my patients during a veterinary consultation?

Many cats rarely leave their home so coming to the veterinary surgery can be very stressful. Every aspect of the experience from being caught and placed in the travel basket to the consultation at the surgery is stressful. So preparations to reduce stress should begin before the cat even leaves home. Owners should be encouraged to get their cat used to the cat carrier or cat basket early in life using treats, play and attention in and around the basket. This will help the cat associate the basket with pleasant things. On the day of the consultation, the owner should first gently coax or lure the cat into a small room, such as the bathroom, before they get the cat basket out, so that the cat does not have to endure a stressful chase and capture. It can be helpful to apply some pheromone spray in the cat basket *before* travel, according to the manufacturer's instructions. Once at the veterinary clinic, it is helpful to have separate waiting areas for dogs and cats. If possible, you may wish to schedule cat consultations at one time of day and dog examinations at another. Planning ahead before the cat and owner come into your consultation room is also useful. Have everything you need ready and close at hand so that you do not have to open noisy drawers or cupboards or make sudden movements. How you remove the cat from the carrier when it arrives in the consulting room can set the tone for the rest of the consultation. If the cat will not walk out voluntarily, it is best not to shake or drag it out of the carrier. Instead, remove the top and gently lift the cat out after allowing it a few seconds to acclimatise to the brightness of the room. Have the table ready with a towel or non-slip mat to give the cat a more comfortable place to sit. It often helps to move slowly and try to keep one hand gently resting on the cat at all times to make them feel safe. If the cat needs to be restrained, less is more.

Rather than holding the cat in one place, try to steer it with your hands so that it stays on the table. If physical restraint is essential, wrap the cat in a towel and gently cover its head and eyes. This causes less fear and defensiveness than scruffing the cat and stretching it out. Finally, in some cases using a pheromone diffuser in the room on a constant basis and pheromone spray on your clothing prior to the consultation may calm some cats.

#### B) How can I reduce stress during hospitalisation?

Hospitalisation is a stressful experience for the cat. Once treatment is over, the return home may be especially traumatic if there are other cats living in the household. The smell of the other animals, people, drugs and of the disinfectants remain on the animal for several days and this may induce aggressive reactions on the part of the other cats of the house.

To reduce the cat's stress after hospitalisation and make its re-introduction to the other household animals easier, it is important proceed as gradually as possible. It is best to start by isolating the cat in a separate room with its own food, water, litter and toys. This will give it a chance to enjoy a quiet and undisturbed place and will enable the other cats to get used to the smell of the returning cat. A cat that has been through particularly stressful experiences, such as hospitalisation, may develop an aversion to food or anorexia. Keeping it separate from other cats can therefore prove useful, giving it more time to eat in peace and quiet.

Here are some general recommendations for re-introduction:

- Advise the owner to start letting the cat interact briefly with the other cats in the household. Start by allowing the other cats to approach the closed door to the returning cat's room so that they can smell each other under the door and sense each other's presence.



- Continue this gradual re-introduction by exchanging the bedding used by the cats in their resting places and by rubbing a cloth around the head and mouth of one cat and then leaving it in the other cat's area. Once the cats are confident with this, they may begin to rub against the other cat's cloth spontaneously when it is presented to them. If not, then the owner may rub each cat with the other's cloth.
- Whenever the cats show a relaxed and positive interest in each other, they should be given plenty of rewards such as play, attention and special food treats. Then the owner can start brief periods of supervised face-to-face interaction between the cats. The first time, it is safest to place the cat that was hospitalised inside a carrier, enabling the other cats in the household to approach it gradually. This reduces the risk of fighting.

It is important for the cats to connect each other's presence with something pleasant and not to develop fear or anxiety about each other's presence:

- Make every experience pleasant using food, attention and play when the cats react well to each other.
- Gradually increase the time when the cats are together.
- The cats should only be left together unsupervised when no expressions of fear or aggression have been seen during a number of encounters. It is important to explain to the owner that this process may take several weeks if the cats are not particularly sociable, while friendly cats used to socialising can re-adapt to each other fairly quickly.

---

### C) Is it effective to treat anxiety solely with drugs?

Behavioural problems can only be resolved permanently through the use of behavioural therapy and environmental modification. Treating anxiety solely with drugs will only bring about a temporary improvement. Using carefully selected drugs together with behavioural therapy can improve the prognosis or the quality of improvement. Vets are lucky to have this extra tool in their repertoire but they must not abuse it. Anxiety often leads to aggression. The risk associated connected with aggression can delay or prevent successful treatment. The control of emotions leading to aggression using medication can be essential in enabling safe treatment.

By definition, anxiety hinders adaptation. The anxious

animal struggles to adapt, to learn new ways of behaving or to abandon deeply-rooted habits. The treatment of anxiety using medication can give back cerebral plasticity and allow the cat to learn new things. In a pet suffering from social phobia, for example, the cat may have great difficulty in performing the basic sequences of behaviour needed to form relationships with other living beings. Their recovery can be greatly facilitated using certain drugs that reduce anxiety and promote the desire to explore. Some cats suffer physically from their anxiety with feelings of nausea, palpitations or difficulty in breathing when in a stressful situation. This creates a negative feed-back effect that further encourages the cat to avoid the same alarming situations. This avoidance prevents the cat from ever getting used to a stimulus. Once again certain drugs that relieve these unpleasant physical sensations, and thereby reduce anxiety, can enable the animal to cope better within its environment.

---

### D) How do I convince my client that the cat is anxious?

The signs of anxiety in cats are subtle and it is important to teach clients to recognise the signs that they may see. Main points to look for are the way the cat moves around, how it rests and the balance of its activity. Anxious cats are less confident when moving around the home. They will startle easily and may be tentative about the way that they approach things. For example, they may hesitate when going to a feeding area or when approaching the owner. When resting, an anxious cat will not fold its feet under its body in the way that a relaxed cat will. Anxious cats may also have more dilated pupils and their muscles may remain tense even while they are resting. Anxious cats may eat less, play less and alter their grooming patterns. Their coat may appear uncared for or patchy even though they may appear to lick themselves a lot.

Perhaps the best way to convince clients is to compare their cat's current activity, sociability and health with a previous time when it was apparently free from anxiety. Alternatively, a comparison with another cat may help to illustrate the differences. Owners find it easier to relate to changes and differences in behaviour, especially when these represent a loss or absence of something that they valued about their cat, such as its playfulness, friendliness or beauty.

Many people are familiar with the feeling of anxiety and the effect that it can have because they may remember times when they experienced anxiety in their own lives. Loss of appetite, nausea, palpitations, wariness and a desire to escape or hide are all feelings that most people will have experienced at some time, such as during examinations, musical performances or public speaking events. Encouraging clients to remember and mentally relive these events can enable them to recognise, understand and empathise with the anxiety their cat may be experiencing.

- It sometimes adopts a posture with its body flattened, its tail down or tucked underneath its body and its ears pinned back against its head.
- The cat always seems very alert and reactive to sounds and movements.
- It often hides or tries to find places to hide.
- It paces restlessly around in the house.
- The cat follows the owner a lot or demands attention very often.
- It shows signs of trembling, panting, or enlarged pupils. It frequently licks its lips, swallows or vocalises.
- The cat has episodes of diarrhoea or vomiting.

## 2/ FAQs owner based

### A) I think my cat is anxious. How can I be sure?

It is possible to identify certain factors contributory to anxiety from the cat's history, environment, demeanour and reactions to events. Here are some typical statements made by owners of anxious cats:

- I know that my cat's mother /father /siblings had anxiety disorders.
- My cat's development was unusual or disrupted (it was adopted too early or too late, it lived in a barren environment with very few stimuli or it has been through traumatic experiences).
- I always comfort my cat when it looks anxious to me.
- I always punish my cat for its misbehaviour.
- I have mood changes and my cat takes the brunt of this.
- I have a very large family, plenty of friends who drop in and I frequently have guests at home.
- I have no daily routine. I have moved house several times. I travel a lot and I like changing the furniture or redecorating my home.
- I love animals and I have several already. I often adopt new ones or have animals from the neighbourhood in my home.
- I have a very small home, without many stimuli.

Even if none of the above applies in a particular home, it is possible to identify signs of anxiety from the cat's behaviour:

The owner of an anxious cat might observe that:

- The cat is moody, irritable and aggressive.

If the anxiety persists, then owners will see general changes in behaviour including:

- Eating less / eating inedible substances / eating in places and at times other than the usual ones
- Sleeping less and looking for places to hide
- Grooming itself less than before / repetitively licking itself for hours / pulling or tearing its own fur out
- Soiling in the house / scratching the furniture
- Playing less and being less sociable
- Showing uncharacteristic outbursts of aggression
- Chasing its tail or running in circles

### B) Why does my cat cry all the time?

Firstly it has to be pointed out that certain breeds, such as Orientals and Siamese, are more talkative than others. For these cats it is normal to use a greater amount of vocal communication. It is, therefore, necessary to properly distinguish normal communication from plaintive crying that might be an expression of distress.

#### a) Is the cat's crying a sign of distress?

"When a child cries, look for the cause, before saying that he is a naughty child" wrote the philosopher Alain. And we must never forget this when dealing with pets in general and with cats in particular. Excessive vocalisation can become a nuisance for owners but it is always important to realise that the cat may be unwell or unhappy rather than simply demanding. Vocalisations are generally recognised as becoming anxious when they shift into a higher, sharper frequency.

**b) Is the crying a sign of pain?**

Cats that are in chronic pain may wail and cry a great deal. However, many cats show that they are experiencing problems through a general reduction in activity, including vocalisation, rather than by moaning and complaining a lot. Conditions, such as cystitis, which can lead to intense and acute episodes of pain, will often cause the cat to walk around and wail at the same time.

**c) Is the crying a sign of emotional imbalance or difficulty coping with the environment?**

Territory is critical to the cat's emotional well-being. The basis of the cat's emotional balance lies in the harmony it finds from being able to create suitable places for each of its activities, being able to mark and maintain these places for itself and in their stability over time. A cat that paces the house and cries may have lost its landmarks, especially the scent marks that it has left to identify its territory. This may bring on a condition of anxiety or depression in which cats often emit acute and repetitive meows. In the case of depression in an older cat (involution depression), very strained and piercing vocalisations can be heard. This can be even more upsetting for the owners when vocalisation takes place at night due to a reversal of day and night time activity patterns.

Sometimes, simply removing the cover of the litter tray will help resolving anxiety problems



best to regard a happy solitary cat as not in need of a companion. If you do decide to introduce a new cat, then it is important to follow the guidelines on matching and introducing cats. If you want to introduce a kitten, it may be better to have two rather than one, so that they have a playmate and are less likely to be a nuisance to the resident cat.

**C) I had two cats and one died. Should I introduce a new cat as a companion? My cat is alone, does it need a companion?**

Cats don't have an absolute need for companionship in the way that people and dogs do. They are capable of forming strong bonds with other cats, people and other animals but they can also be perfectly happy living alone as long as their needs for space and activity are met. Relationships between cats are very special and unique, much like friendships between people, so it is not possible to introduce a new cat as a direct substitute for one that has died. The existing cat is unlikely to develop a strong relationship with the newly-introduced cat in the way that existed with its previous companion. In fact, bringing a new cat into the home could cause additional stress and conflict at a time when the resident cat is readjusting to life without its companion. In general, it is

**D) I love having lots of cats. Is that good for them?**

While we know that cats live within social groups, these usually are composed of mothers, daughters, aunts and their juvenile offspring. In other words, the adult part of a cat social group is mainly female. We also know that cats have different personalities and experiences that will affect how they interact with other cats.

When cats do form relationships with each other, these are often on an individual basis, i.e. they choose to spend time with cats that they like and avoid others. In creating our own "cat colony", we need to take into consideration the relationships, temperament and early experiences of the cats we bring into our home. A cat with a history of anxious behaviour and hiding may do best with a calm, confident cat. A cat that has lived alone all its life may not have learned how to interact socially with other cats and may find new companions stressful. It may be happier living alone. An elderly cat may find a young, boisterous kitten to be overwhelming. In a small home

there may not be enough space for all the cats to maintain a comfortable distance from each other. Often adopting related females may help to create a more harmonious situation.

Another consideration is how cats share and manage the space in which they live. In large cat groupings, it appears that not all cats use the entire area available to the group. This is usually due to social constraints with the other cats. To help create harmony in a multiple-cat home, it is important to make sure that the resources that the cats need are spread throughout the entire environment so that every cat has easy access to all the things it needs. This means multiple locations for food and water bowls, resting areas and litter trays. It also is useful to provide plenty of hiding places and escape routes so that each cat can get away from the other cats if it so chooses.

- If the cat confines itself to a particular area of its territory, you can help by turning it into a “safe area”:
  - Move the cat litter tray, food and water to this place.
  - Keep food and water separated from the litter tray.
  - Do not force the cat to leave this place.
  - Place a synthetic pheromone vaporiser there.
- Avoid excessive handling and petting. It is best to give attention only when the cat actively seeks it.
- If there is an aggressive conflict with another cat, it is best to temporarily separate the territory available to the cats. Give them their own areas, each containing a litter tray, water and food.
- For multi-cat households, more than one litter tray must be available. As a rule of the thumb, the number of litter trays should equal the number of cats plus one. Of course, all litter trays must be placed in separated locations. Some cats prefer to have litter trays without covers, so removing a cover may help to reduce anxiety. ■

---

## E) What should I do when I observe clinical anxiety in my cat?

The solution to an anxiety disorder requires a detailed analysis of the problem by a veterinary surgeon. However, there are some general recommendations that can be applied safely in the event of the presence of clinical anxiety.

# References

## Chapter 1

- Appleby D., Plujmakers J. (2003) Separation anxiety in dogs. The function of homeostasis in its development and treatment. *Vet Clin North Am Small Anim Pract.* 33(2): pp 321-44.
- Bear M.F., Connors B.W., Paradiso M.A. (2001) Neuroscience: exploring the brain, Eds. Lippincott Williams & Wilkins. pp 588-591.
- Berton F., Vogel E., Belzung C. (1998) Modulation of Mice Anxiety in Response to Cat Odor as a Consequence of Predators Diet. *Physiology & Behavior.* 65(2): 247-254.
- Cameron M.E., Casey R.A., Bradshaw J.W.S., Waran N., Gunn-Moore D. (2001) A study of the environmental and behavioural factors involved in the triggering of idiopathic cystitis in the domestic cat. *BSAVA Congress 2001 Scientific Proceedings.* p.505.
- Casey R. (2002) Fear and stress in companion animals. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester UK. pp 144-153.
- Dantzer R., Mormede P. (1981) Pituitary adrenal consequences of adjunctive behaviours in pigs. *Horm Behav.* 15, pp 386-395.
- Dehasse J., De Buysse C. (1993) Socio-écologie du chat. *Pratique Médicale et Chirurgicale de l'Animal de Compagnie:* 28. pp 469-478.
- Frank D. (2002) Management problems in cats. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 80-89.
- Frank D., Dehasse J. (2003) Differential diagnosis and management of human-directed aggression in cats. *Vet Clin Small Anim:* 33, pp 269-286.
- Gagnon A.C., Chaurand J.P., Larue J.F. (1993) Comportement de chat et ses troubles, Editions du Point Vétérinaire. Maisons-Alfort.
- Heath S. (2002) Feline aggression. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 216-228.
- Horwitz D.F. (2002) House soiling by cats. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 97-108.
- Haupt K.A. (1991) House soiling: treatment of a common feline problem. *Veterinary Medicine.* 86. pp 1000-1006.
- Luescher A.U. (2002) Compulsive behavior. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 229-236.
- Mason G. (1991) Stereotypies: a critical review. *Animal Behaviour:* 41. pp 1015-1037.
- McCune S. (1995) The impact of paternity and early socialisation on the development of cats' behaviour to people and novel objects. *Applied Animal Behaviour Science:* 45. pp 109-124.
- Neilson J.C. (2002) Fear of places and things. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 173-180.
- Reisner I. (2002) An overview of aggression. In: *BSAVA Manual of Canine and Feline Behavioural Medicine.* Horwitz D., Mills D., Heath S. (Eds), British Small Animal Veterinary Association, Gloucester, UK, pp 181-194.
- Thomas K.J., Murphee O.D., Newton J.E.O. (1972) Effect of person and environment on heart rates in two strains of pointer dogs. *Conditional Reflex:* 7(2), 74-81.
- Weiss J.M. (1972) Psychological factors in stress and disease. *Scientific American:* 226, pp 104-113.

## Chapter 2

- Bagley R. S., Gavin P. R. et al. (1999) Clinical signs associated with brain tumors in dogs: 97 cases (1992-1997). *J Am Vet Med Assoc.* 215(6): 818-9.
- Beaver B.V., Haug L.I. (2003) Canine behaviors associated with hypothyroidism. *J Am Anim Hosp Assoc.* 39(5): 431-4.
- Blackwood L., Argyle D.J. (2002) Feline hyperthyroidism: advances towards novel molecular therapeutics. *J Small Anim Pract.* 43(2): 58-66.
- Bourdin M. (1992) Psychodermatologie: Mythe ou réalité?
- Buffington C. A., Teng B., et al. (2002) Norepinephrine content and adrenoceptor function in the bladder of cats with feline interstitial cystitis. *J Urol.* 167(4): 1876-80.
- Buffington C. A., Westropp J.L., et al. (2006) Clinical evaluation of multimodal environmental modification (MEMO) in the management of cats with idiopathic cystitis. *J Feline Med Surg.*

- Carroll D., Davey Smith G., et al. (2006) Birth weight, adult blood pressure, and blood pressure reactions to acute psychological stress. *J Epidemiol Community Health*. 60(2): 144-5.
- Chew D. J., Buffington C.A., et al. (1998) Amitriptyline treatment for severe recurrent idiopathic cystitis in cats. *J Am Vet Med Assoc*. 213(9): 1282-6.
- Daminet S., Béata C. (2005) *Endocrinology and Behaviour*. 11th Congress of ESVCE - Behaviour and Internal Medicine.
- Depaulis A., Helfer V., et al. (1997) Anxiogenic-like consequences in animal models of complex partial seizures. *Neurosci Biobehav Rev*. 21(6): 767-74.
- Fatjó J., Stub C., et al. (2002) Four cases of aggression and hypothyroidism in dogs. *Vet Rec*. 151(18): 547-8.
- Fujikawa T., Soya H., et al. (2004) Prolactin prevents acute stress-induced hypocalcemia and ulcerogenesis by acting in the brain of rat. *Endocrinology*. 145(4): 2006-13.
- Gerbier C. (2002) Contribution à l'étude de l'existence d'une corrélation entre la dermatite atopique et les troubles émotionnels chez le chien. Mémoire pour le diplôme de Vétérinaire Comportementaliste diplômé des ENVF.
- Grandin T. (1994) Euthanasia and slaughter of livestock. *J Am Vet Med Assoc*. 204(9): 1354-60.
- Grandin T. (1997) Euthanasia and slaughter of livestock. *J Anim Sci* 75: 249-57.
- Gue M., Peeters T., et al. (1989) Stress-induced changes in gastric emptying, postprandial motility, and plasma gut hormone levels in dogs. *Gastroenterology* 97(5): 1101-7.
- Gunn-Moore D. A., Cameron M.E. (2004) A pilot study using synthetic feline facial pheromone for the management of feline idiopathic cystitis. *J Feline Med Surg*. 6(3): 133-8.
- Jones A., Godfrey K.M., et al. (2006) Fetal growth and the adrenocortical response to psychological stress. *J Clin Endocrinol Metab*. 91(5): 1868-71.
- Marion M. (2002) Contribution à l'étude du lien entre les troubles gastriques chroniques et l'anxiété chez le chien. Mémoire pour le diplôme de Vétérinaire Comportementaliste diplômé des ENVF: 45 pages.
- Martin K. M., Rossing M.A., et al. (2000) Evaluation of dietary and environmental risk factors for hyperthyroidism in cats. *J Am Vet Med Assoc*. 217(6): 853-6.
- McCobb E. C., Patronek G.J., et al. (2005) Assessment of stress levels among cats in four animal shelters. *J Am Vet Med Assoc*. 226(4): 548-55.
- Mege C. (1997) Dermatoses liées à des troubles du comportement chez le chat.
- Mooney C. T. (2001) Feline hyperthyroidism. Diagnostics and therapeutics. *Vet Clin North Am Small Anim Pract*. 31(5): 963-83, viii.
- Nelson R. (2002) Stress hyperglycemia and diabetes mellitus in cats. *J Vet Intern Med*. 16(2): 121-2.
- O'Brien T. D. (2002) Pathogenesis of feline diabetes mellitus. *Mol Cell Endocrinol*. 197(1-2): 213-9.
- Osborne C. A., Kruger J.M., et al. (1999) Feline urologic syndrome, feline lower urinary tract disease, feline interstitial cystitis: what's in a name? *J Am Vet Med Assoc*. 214(10): 1470-80.
- Pageat P. (1995) Pathologie du comportement du chien. Maisons-Alfort, Éditions du Point Vétérinaire.
- Rothrock N. E., Lutgendorf S.K., et al. (2001) Stress and symptoms in patients with interstitial cystitis: a life stress model. *Urology*. 57(3): 422-7.
- Sawyer L. S., Moon-Fanelli A.A., et al. (1999) Psychogenic alopecia in cats: 11 cases (1993-1996). *J Am Vet Med Assoc*. 214(1): 71-4.
- Virga V. (2003) Behavioral dermatology. *Vet Clin North Am Small Anim Pract*. 33(2): 231-51, v-vi.
- Zavala F. (1997) Benzodiazepines, anxiety and immunity. *Pharmacology and Therapeutics*. 75(3):199-216.
- Westropp J. L., Buffington C.A. (2004) Feline idiopathic cystitis: current understanding of pathophysiology and management. *Vet Clin North Am Small Anim Pract*. 34(4): 1043-55.

---

## Chapter 3

- Corbett L.K. (1979) Feeding ecology and social organisation of wild cats (*Felis silvestris*) and domestic cats (*Felis silvestris catus*) in Scotland. PhD thesis. University of Aberdeen.
- Durr R., Smith C. (1997) Individual differences and their relation to social structure in domestic cats. *J. Comp. Psycho*. 111(4):412-8.
- Feaver J.M., Mendl M.T., Bateson P. (1986) A method for rating the individual distinctiveness of domestic cats. *Animal Behaviour*. 34:1016-25.
- Heath S., 2002. Feline aggression. In: BSAVA Manual of Canine and Feline Behavioural Medicine, Horwitz D., Mills D., Heath S. (Eds.). British Small Animal Veterinary Association, Gloucester, UK. 216-228.
- Kerby G., Macdonald D.W. Cat Society and Consequences of Colony Size. In Turner D.C., Bateson P. (Eds.) (1988) *The Domestic Cat: The Biology of Its Behaviour*. Cambridge University Press.
- Konecny M.J. (1983) Behavioural ecology of feral house cats in the Galapagos Islands, Ecuador. PhD Thesis. University of Florida, Gainesville.

Leyhausen P. (1988) *The tame and the wild- another Just-So Story?* In Turner D.C., Bateson P. (Eds.) (1988) *The Domestic Cat: The Biology of Its Behaviour*. Cambridge University Press.

Natoli E., Say L., Cafazzo S., Bonanni R., Schmid M., Pontier D. (2005) Bold attitude makes male urban feral domestic cats more vulnerable to Feline Immunodeficiency Virus. *Neuroscience and Biobehavioral Reviews*. 29: 151–157.

Panamans R. (1981) Behavior and ecology of free-ranging female farm cats. *Z Tierpsychol*. 56:59-73.

Pierpaoli M., Biro Z.S., Herrmann M., Hup K., Fernandes M., Ragni B., Szemethy L., Randi E. (2003) Genetic distinction of wildcat (*Felis silvestris*) populations in Europe, and hybridization with domestic cats in Hungary. *Molecular Ecology*. 12:2585–2598.

Reisner I.R., Houpt K.A., Erb H.N., Quimby F.W. (1994) Friendliness to humans and defensive aggression in cats: the influence of handling and paternity. *Physiol Behav*. 55(6):1119-24.

Turner D.C., Bateson P. eds. (2000) *The Domestic Cat: The Biology of Its Behaviour*. Cambridge University Press.

Zeuner F.E. (1963) *A History of Domesticated Animals*. Harper & Row: New York.

---

## Chapter 4

Beaver B.V. *Feline Behavior* (2003) A guide for Veterinarians 2nd edition. Saunders, St. Louis, USA.

Bernstein P., Strack M. (1993) Home ranges, favored spots, time-sharing patterns and tail usage by 14 cats in the home. *Animal Behavior Consultant Newsletter*. 10(3) July.

Crowell-Davis S.L., Curtis T.M., Knowles R.J. (2004) Social organization in the cat: a modern understanding. *Journal of Feline Medicine and Surgery*. 6: 19-23.

Denenberg S. (2003) Cat toy play trial: a comparison of different toys. AVSAB/ACVB Scientific Symposium. Denver.

Hall S.L., Bradshaw J.W.S., Robinson I.H. (2002) Object play in adult domestic cats: the role of habituation and disinhibition. *Applied Animal Behaviour Science*. 79: 263-271.

Heidenberger E., (1997) Housing conditions and behavioural problems of indoor cats as assessed by their owners. *Applied Animal Behaviour Science*. 52: 345-364.

Houpt K.A. (2005) *Domestic Animal Behavior for Veterinarians and Animal Scientists*. Blackwell Publishing, Oxford, England 23-26.

Karsh E.B. (1984) Factors influencing the socialization of cats to people In: *The Pet Connection: its influence on our health and quality of life*.

Anderson R., Hart B., Hart L. (Eds.). University of Minneapolis Press, Minneapolis. 207-215.

Karsh E.B., Turner D.C. (1988) *The human-cat relationship* In: *The Domestic Cat: the biology of its behaviour*. Turner D., Bateson P. (Eds.). Cambridge University Press, Cambridge. 159-77.

Levine E., Perry P., Scarlett J., Houpt K.A. (2005) Intercat aggression in households following the introduction of a new cat. *Appl Anim Behav Sci*. 90: 325-336.

Lowe S.E., Bradshaw J.W.S. (2001) Effects of socialization on the behaviours of feral kittens In: *Proceedings of the third International Congress on Veterinary Behavioural Medicine*. Overall K., Mills D., Heath S., Horwitz D. UFAW, Herst, UK. 28-29.

Neville P.F. (2004) An ethical viewpoint: the role of veterinarians and behaviourists in ensuring good husbandry for cats. *Journal of Feline Medicine and Surgery*. 6: 43-48.

McCobb E.C., Partonek G.J., Marder A., Dinnage J.D., Stone M.S. (2005) Assessment of stress levels among cats in four animal shelters *Journal of the American Veterinary Medical Association*. 226(4): 548-555.

---

## Chapter 5

Bear M.F., Connors B.W., Paradiso M.A. (1998) *Neurociencia: explorando el cerebro*. Masson-Williams & Wilkins, Barcelona, pp 401-430.

Béata C., C Lefranc-Millot, et al. (2005) Lactium: a new anxiolytic product coming from milk. *Current Issues and Research in Veterinary Behavioral Medicine*, Minneapolis, Purdue University Press.

Beaver B.V. (2003a) *Feline Ingestive Behavior*. In: *Feline Behavior: A Guide for Veterinarians*. Saunders, Philadelphia, pp 221-246.

Beaver B.V. (2003b) *Introduction to Feline Behavior*. In: *Feline Behavior: A Guide for Veterinarians*. Saunders, Philadelphia, pp 1-41.

Center S.A., Elston T.H., Rowland P.H. (1996) Fulminant hepatic failure associated with oral administration of diazepam in 12 cats. *J Am Vet Med Assoc*. 209, pp 618–625.

Ciribassi J., Luescher A., Pasloske K.S., Robertson-Plouch C., Zimmerman A., Kaloostian-Whittymore L. (2003) Comparative bioavailability of fluoxetine after transdermal and oral administration to healthy cats. *Am J Vet Res*. Aug; 64(8), pp 994-998.

Crowell-Davis S.C., Murray T. (2006a) Azapirones. In: *Veterinary Psychopharmacology*. Blackwell Publishing, Ames, pp 111-118.

Crowell-Davis S.C., Murray T. (2006b) Combinations. In: *Veterinary Psychopharmacology*. Blackwell Publishing, Ames, pp 234-240.

Cummings J.L., Mega M.S. (2003) Anxiety Disorders. In: *Neuropsychiatry and Behavioural Neuroscience*. Oxford University Press, New York. pp 244-252.

- Eckstein R.A., Hart B.L. (1998) Pharmacological Approaches to Urine-Marking in Cats. In: Dodman NH., Shuster L (Eds) *Psychopharmacology of Animal Behaviour Disorders*. Blackwell Science, Oxford, pp 264-276.
- Griffith C.A., Steigerwald E.S., Buffington T. (2000) Effects of synthetic facial pheromone on behaviour of cats. *J Am Vet Med Assoc.* 217, pp 1154–1156.
- Hart B.L., Cliff K.D., Tynes V.V., Bergman L. (2005) Control of urine marking by use of long-term treatment with fluoxetine or clomipramine in cats. *J Am Vet Med Assoc.* 226 (3): pp 378-82.
- Heath S. (2002) Behaviour problems in the geriatric pet. In: Horwitz D, Mills D, Heath S, (eds.) *BSAVA manual of canine and feline behavioural medicine*. Gloucester: British Small Animal Veterinary Association, pp 109-118.
- Horwitz DF. (2002) Separation-related problems in dogs. In: Horwitz D, Mills D, Heath S, (eds.) *BSAVA manual of canine and feline behavioural medicine*. Gloucester: British Small Animal Veterinary Association, pp 154-163.
- Hostutler R.A., Chew D.J., DiBartola S.P. (2005) Recent Concepts in Feline Lower Urinary Tract Disease. In: Richards JR (Ed) *Advances in Feline Medicine*. *Veterinary Clinics of North America: Small Animal Practice.* 35, pp 147-170.
- Hunthausen W. (2000) Evaluating a feline facial pheromone analogue to control urine spraying. *Veterinary Medicine.* 95, pp 151–156.
- Landsberg G., Hunthausen W., Ackerman L. (2003) Pharmacological Intervention in Behavioural Therapy. In: *Handbook of Behavior Problems of the Dog and Cat* (2nd ed). Saunders, Philadelphia, pp 117-151.
- Landsberg G (2005) Therapeutic agents for the treatment of cognitive dysfunction syndrome in senior dogs. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 29(3), pp 471-479.
- Mealey K.L., Peck K.E., Bennett B.S., Sellon R.K., Swinney G.R., Melzer K., Gokhale S.A., Krone T.M. (2004) Systemic absorption of amitriptylline and buspirone after oral transdermal administration to healthy cats. *J Vet Intern Med.* Jan-Feb; 18(1): 43-6.
- Mertens P.A., Dodman N.H. (1998) Pharmacological Treatment of Fear and Anxiety in Animals. In: Dodman NH & Shuster L (Eds) *Psychopharmacology of Animal Behaviour Disorders*. Blackwell Science, Oxford, pp 122-140.
- Miclo L., Perrin E., et al. (2001) Characterization of alpha-casozepine, a tryptic peptide from alpha-s1 casein with benzodiazepine-like activity. *FASEB journal express*. Volume, DOI:
- Miczek K.A., Fish E.W. (2006) Monoamines, GABA, Glutamate, and Aggression. In: Nelson RJ (ed.) *Biology of Aggression*. Oxford University Press, New York, pp 114- 149.
- Pageat P., Gaultier E. (2003) Current research in canine and feline pheromones. *Veterinary Clinics of North America: Small Animal Practice* 33, pp. 187–211.
- Pryor P.A., Hart B.L., Cliff K.D., Bain M.J. (2001) Effects of a selective serotonin reuptake inhibitor on urine spraying behaviour in cats. *J Am Vet Med Assoc.* 219(11), pp 1557-61.
- Schroeder H., Violle N., et al. (2003) "Effects of ING-911, a tryptic hydrolysate from bovine milk alpha-S1casein on anxiety of Wistar male rats measured in the conditioned defensive burying (CDB) paradigm and the elevated plus maze test." *Behavioural Pharmacology.* 14(S1): 31.
- Stahl S.M. (2000) Anxiolytics and Sedative-Hypnotics. In: *Essential Psychopharmacology. Neuroscientific Basis and Practical Applications* (2nd ed) Cambridge University Press, Cambridge, pp 297-333.
- Stryjer R., Shiloh R., Weizman A., Nutt D. (2005) *Atlas of Psychiatric Pharmacotherapy*. Taylor & Francis.
- Virga V. (2003) Behavioral Dermatology. *Veterinary Clinics of North America: Small Animal Practice* 33(2), pp 231-251.



