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Welcome to April’s edition of *Feline Focus*. We are pleased to start with a really informative article from Helen Bolter on cognitive dysfunction syndrome in cats. As the cat population ages we are likely to see more affected cats and, as you will see from Helen’s article, there is a lot we can do for them. This issue also continues our parasite series. In this, the second of four articles in the series, Ian Wright focuses on ectoparasites other than fleas. As part of our Keeping Cats Safe campaign, we are also encouraging nurses and technicians to promote microchipping. Microchipping is the safest way to provide identification and comes without the risk of injuries associated with wearing a collar. Finally, Lauren Finka provides us with a fantastic article on minimising stress in the multi-cat home, with plenty of useful tips to tell clients and apply in our own homes as well as in homing centres.

Thanks as always for supporting our ISFM nurse and technician membership (which has nearly reached 7000 members). Help more cats by encouraging your colleagues to join too! Best wishes,

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Cognitive dysfunction syndrome: how to help older cats with dementia

Cognitive dysfunction syndrome is an Alzheimer’s-like dementia that can affect elderly cats. Clinical signs include confusion, inappropriate toileting and crying out at night for no apparent reason. These behavioural changes can mimic, be exacerbated by, or be masked by other disease processes, complicating the diagnosis. A careful diagnosis of exclusion is necessary. There are currently no licensed medicines for the treatment of cognitive dysfunction in cats and there is no cure or reliable way to prevent onset. However, some drug therapies or nutritional supplements may help to ameliorate clinical signs. Environmental enrichment can make a big difference to affected cats. Veterinary nurses and technicians can prove pivotal in the identification of behavioural changes and provision of advice to owners on how to improve quality of life for affected cats.

Modern medicine and improvements in diet have led to an increased life expectancy for pet cats. Many of the clinical signs cats display later in life are dismissed by owners and veterinary staff alike as simply being ‘old age’ related, yet senior cats often suffer with one or more chronic diseases. Because cats often hide signs of illness, their signs can go unnoticed, undiagnosed or untreated.

Cats are considered ‘senior’ when they are between 11 and 14 years old and ‘geriatric’ when they are 15 years or older. In the USA, over 10% of pet cats are senior, and in the UK approximately 8.5% of the pet cat population is over 14 years old. Cognitive dysfunction syndrome (CDS) is becoming increasingly recognised by the veterinary profession and affected older cats can do well with appropriate treatment (Figure 1).

What is CDS?
CDS is an Alzheimer’s-like form of dementia that can affect older animals, including cats.

Helen Bolter graduated as a veterinary surgeon from Bristol Veterinary School, UK, in 2008 and, in the same year, received an award from the UK charity Cats Protection for a research proposal into blood pressure monitoring in geriatric cats. Having worked in small animal practice for just under a year, Helen went to South Africa and Namibia to work with big cats. Helen currently runs cat-only clinics in the UK. She has an interest in geriatric medicine, having herself given a home to several older cats. Helen is also a tutor on International Cat Care’s cat professional and nursing distance education courses.
Hallmark pathological findings include \( \beta \)-amyloid plaques and AT8-immunoreactive phosphorylated tau deposits. Neurofibrillary tangles, present in the brains of humans with Alzheimer’s, are not thus far reported in cats, but hyperphosphorylated tau may represent pre-tangle pathology.\(^{5,6}\) While the cause still remains unknown, risk factors associated with the development of CDS include genetic, metabolic and nutritional influences. A reduction in cerebral circulation and chronic oxidative damage are both believed to be particularly important.\(^{6,7}\)

As animals grow older, cells become less metabolically efficient causing an increase in the production of free radicals, which lead to oxidative damage of the body’s tissues.\(^{8,9}\) All cells produce some free radicals during aerobic metabolism and antioxidants ‘mop’ them up. The body’s own antioxidants include specific enzymes but also antioxidant vitamins, such as A, C and E, which are derived from the diet. Stress and some disease processes also affect the balance of free radicals produced vs antioxidants available. The ageing brain is particularly susceptible to oxidative damage for three reasons:
- the brain has a very high demand for oxygen;
- vascular changes, clotting defects, hypertension or anaemia in older animals can lead to a decrease in cerebral blood flow; and
- neural tissue has a very limited capacity for repair.\(^{7,10,11}\)

**How common is CDS?**
The average age of onset of CDS in cats has yet to be established, but studies suggest that age-related behavioural changes consistent with CDS (see Box 1) are prevalent in cats from as early as 10 years old, with the prevalence increasing with age.\(^{12}\) One study found that approximately a third of senior pet cats and over half of geriatric pet cats exhibited behavioural changes that were attributed to CDS.\(^{13}\) Another study found that 88% of owners of cats between 16 and 19 years old reported that their cats had behavioural changes.\(^{14}\)

**Making a diagnosis of CDS**
It is important to remember that many conditions and some drug side effects can mimic or complicate CDS (see Box 2). A full diagnosis of CDS relies on a post-mortem examination of the affected cat’s brain. In practice, cats with senior-onset behavioural changes that cannot be attributed to any other medical cause or drug side-effect can be diagnosed as CDS. CDS is effectively, therefore, a diagnosis of exclusion.

Taking a thorough clinical history, performing blood tests, blood pressure measurement and urine analysis (plus, on occasions, imaging
such as radiographs or ultrasound examinations) may all be necessary in order to differentiate between clinical signs caused by common geriatric health conditions and those caused by CDS.

During veterinary consultations, cat owners are likely to report serious behavioural changes in their cats, but the more subtle signs may be overlooked by even the most conscientious of owners. Veterinary nurses and technicians are invaluable in assisting in identification and reporting of signs associated with declining health or cognition. Time spent with owners and asking the relevant questions (see Table 1) can allow for early diagnosis of CDS (and other age-related conditions), providing an opportunity for early and effective intervention.

**Box 1: Clinical signs of CDS**

Behavioural changes that may be attributed to CDS in older cats include:
- becoming withdrawn or less responsive;
- crying loudly, especially at night;
- increased attention seeking;
- irritability;
- aggression;
- anxiety;
- forgetfulness, for example, forgetting they have been fed and repeatedly requesting food;
- sleeping more or exhibiting altered sleep patterns;
- reduction in activity;
- pacing or walking in circles;
- reduction in grooming;
- disorientation, for example, forgetting where the cat flap is;
- confusion;
- inappropriate urination and/or defaecation, often due to forgetting where the litter tray is.

**Box 2: Behavioural changes and disease in older cats**

Behavioural changes in older cats may be associated with disease processes. These may mimic or complicate the clinical signs of CDS. Examples include, but are not limited to:
- chronic pain (frequently associated with osteoarthritis);
- hyperthyroidism;
- chronic kidney disease (CKD);
- diabetes;
- hypertension;
- urinary tract infections (rare in healthy cats but more common in older cats with diseases such as CKD);
- feline lower urinary tract disease;
- dental pain;
- reduction or loss of vision or hearing;
- anxiety, stress or other behavioural disorders;
- brain tumours (less common).

**How is CDS treated?**

Although CDS cannot be cured, there are treatment and management modalities that can lessen or alleviate signs and may slow the acquisition of β-amyloid plaques in the brain and, thus, delay further cognitive decline. Before any treatment is prescribed, the cat’s full health should be assessed to avoid side effects and inappropriate medications.

**Medical treatment**

Selegiline has been shown (both in the laboratory and in practice) to improve CDS behavioural signs in dogs. Selegiline is not licensed for use in cats, but anecdotal reports describe improvement in clinical signs attributed to CDS. Selegiline may require dosing for 2 weeks or longer before clinical improvement is seen. There are several drugs that...
State of the art

**Hypertension**

Hypertension is common in senior and geriatric cats, often occurring secondarily to conditions such as CKD or hyperthyroidism. Hypertension may lead to damage to many organs, including the retina (reducing the cat’s vision). The clinical signs of hypertension, and the clinical signs of the diseases it occurs secondarily to, can mimic some of the clinical signs of CDS. Blood pressure monitoring is non-invasive and minimally stressful for the patient; it should be undertaken during elderly cat wellness checks, ideally, at least every 6 months.

**Key point**

Before making a diagnosis of CDS, other conditions that cause similar clinical signs or may complicate CDS should be ruled out. Pain from osteoarthritis and hypertension can be common.

cannot be used alongside selegiline and one of these, tramadol, is occasionally used in elderly cats for arthritic pain.

Propentofylline is licensed for the treatment of lethargy and depressed demeanor in old dogs. It may increase blood flow to the brain and have neuroprotective properties. Propentofylline has been used in cats with improvements anecdotally reported, but results have not been published.

Other drug options, aimed solely at ameliorating anxiety, include buspirone, benzodiazepines or antidepressants. In cats, and especially those with compromised liver function, clonazepam or lorazepam may be safer benzodiazepines to choose, because they have no active metabolites. Diazepam, another benzodiazepine, can cause idiosyncratic hepatic necrosis in cats.

Antidepressant choices must be made from drugs that lack anticholinergic effects (eg, fluoxetine) because diminished cholinergic function is reported in elderly cats.17,18 Fluoxetine has been available in some countries as a licensed product for the treatment of anxiety in dogs, but has now been discontinued. Human licensed fluoxetine is available.

Pain may exacerbate anxiety-like behaviours and may contribute to behaviours such as crying out or waking at night, so suitable analgesics must also be considered if appropriate. Gabapentin can be used both as an adjunct in a multimodal analgesic protocol and also for its sedative effects.19 Non-steroidal anti-inflammatory drugs may be used, not only for analgesia, but also to reduce neuronal damage.20 However, consideration must be given to the cat’s hepatic and renal functions before these are prescribed.

**Tip**

A client questionnaire covering behavioural hallmarks of CDS may flag up the more subtle signs of cognitive decline amongst other health and welfare concerns in the elderly patient.

**Note:** Medicine licensing varies between countries. Follow local prescribing rules.

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Nutraceuticals
There are several nutraceutical products on the market that have proven benefits for the treatment of CDS in dogs. Evidence of efficacy in cats is currently lacking.

The theory behind these supplements is that essential fatty acids (EFAs) and other antioxidants should reduce oxidative damage and therefore reduce the production of amyloid plaques. In humans, antioxidants such as vitamin A, C and E and EFAs have been shown to reduce oxidative damage and slow the progression of dementia-like symptoms.\(^{21,22}\) Alpha-lipoic acid and L-carnitine are reported to improve mitochondrial function and prevent mitochondrial decay in neurons. Supplementation of both together improved cognition, memory and activity levels in rats and dogs.\(^{23,24}\)

The studies in older dogs show that nutraceuticals containing antioxidants and other supportive compounds, such as Aktivait (VetPlus) containing omega-3 fish oils, vitamins E and C, L-carnitine, alpha-lipoic acid, co-enzyme Q, phosphatidylserine and selenium, provided a marked improvement in behavioural signs attributed to CDS.\(^{25}\) Another nutraceutical product, Senilife (CEVA Animal Health) containing ginkgo biloba, vitamins B6 and E, and resveratrol, has been shown in studies to offer significant improvements in dogs with CDS.\(^{26}\) The supplementation of older dogs with S-adenosyl-l-methionine was found to improve both their activity levels and their cognitive function.\(^{26-28}\)

Alpha-lipoic acid is toxic in cats, so a supplement Aktivait Cat (VetPlus)
containing omega-3 fish oils, vitamins E and C, L-carnitine, co-enzyme Q10, etc, but without the alpha-lipoic acid is available.21

S-adenosyl-L-methionine (SAMe) is found in all living cells and is a commonly used supplement for liver dysfunction. SAMe may help to maintain cell membranes, receptor function, and certain cellular transmitters, as well as increase the production of endogenous antioxidants.29 Placebo-controlled studies found improvement in activity and awareness in cats and dogs supplemented with SAMe for at least 8 weeks.30–32 SAMe supplementation may increase central serotonin levels, so caution should be used when combining it with drugs that may also have these effects.

The other nutraceuticals are predominantly aimed at reducing the anxiety that these cats experience. Night waking and crying can negatively effect an owner’s sleep and should be taken seriously by veterinary professionals. Natural compounds that may reduce anxiety and help re-establish normal sleep-wake cycles include L-theanine (Anxitane; Virbac Animal Health), alpha-casozepine (Zylkene; Vetoquinol) and synthetic facial pheromones, which are available as plug-in diffusers or sprays (Feliway; CEVA Animal Health).19

Role of diet in the management of CDS
Research into Alzheimer-type dementia in humans has found that diet-derived antioxidants, in particular fruit derived polyphenolics, are amongst the most effective compounds in counteracting oxidative stress.33,34 Similarly, several studies into CDS in dogs and rats have reported that dietary modification, particularly with supplementation of antioxidants, significantly improved the ability of animals with CDS-like signs to complete cognitive tasks.35

There is some evidence in dogs and people that diets rich in antioxidants and omega-3 may reduce oxidative stress on the brain, thus slowing production of β-amyloid plaques and improving cognitive ability, or even preventing the onset of dementia. In dogs, studies show that when dietary manipulation is used alongside stimulation such as exercise, human interaction and playing games, the effect is superior to diet or stimulation alone. While neither technique can reduce existing β-amyloid plaques, dietary supplementation with antioxidants, vitamin E, beta-carotene, B12 and essential fatty acids may slow the production of the plaques.36,37 In cats there are only preliminary studies into the effect of supplementing

Key point
There are several drug options for CDS in cats, but many only ameliorate clinical signs. Supplements may improve cognitive function by reducing oxidative damage in the brain. Each drug and nutraceutical choice must be made on a case-by-case basis and it is imperative to consider side effects and possible interactions between medications.

Tip
One of the commonly prescribed supplements aimed at dogs with CDS is toxic to cats and so the feline-specific version must always be used.
diets with supportive compounds, but early results show that diets supplemented with vitamins E, C, beta-carotene, L-carnitine, and some select amino acids, led to increased activity levels in elderly cats.\(^{38,39}\)

Supplementation with medium chain triglycerides (MCTs) improves mitochondrial function and decreases amyloid precursor protein in the parietal cortex of aged dogs.\(^{40,41}\) Supplementation with MCTs is also approved as a medical dietary supplement for humans with Alzheimer’s. Unfortunately, these MCTs are plant-based and diets containing sufficiently high levels of them are often unpalatable to cats.

### Key point
Choosing the right diet for an older cat requires consideration of the cat’s preferences, cost, concurrent conditions and body condition. Each cat’s nutritional requirements should be considered on a case-by-case basis. For cats suffering from CDS, feeding can be incorporated into environmental stimulation techniques, such as food balls or puzzle feeders, to improve cognitive function.

However beneficial dietary enrichment may be theoretically, there are important practical considerations when attempting to change the diet of an older cat. These include palatability, body condition score and any other diagnoses that may affect diet choice.

### Environmental enrichment
It has been known since the 1970s that environmental stimulation can lead to neurogenesis (formation of neurons) and reverse the loss of neurons in areas of the brain such as the hippocampus.\(^{42,43}\) Most of this work has been carried out in rats and mice,\(^{42,44}\) but in humans there is considerable evidence that dementia-like symptoms are less prevalent and less severe in those who engage regularly in complex cognitive tasks.\(^{45,46}\)

Environmental enrichment for cats can include using toys and catnip, providing opportunities to explore, climb or perch and instigating food-hunting games, for example by using puzzle-feeders (Figure 2), food balls or even just hiding treats around the home. It can be suggested to owners that they play with their cats, using toys to simulate hunting and pouncing. These games must always be initiated and played on the cat’s own terms.

Inappropriate elimination may be improved by increasing the number and location of litter trays. If necessary, these trays should have low sides, so cats with osteoarthritis can climb in and out easily.

The use of non-slip ramps or steps up to high places may encourage cats with CDS (and osteoarthritis) to explore and climb. A view through a window or a high resting place can also provide mental stimulation (Figures 3 and 4).

It is also important to maintain the day–night cycle for elderly cats, especially for those that spend a considerable amount of time indoors or in one room (see later). This can be achieved by encouraging outdoor exercise and by opening curtains or blinds in the daytime to provide daylight and reduce exposure to artificial light.\(^{19}\) Some older cats prefer their owners to accompany them outdoors. Increased daytime stimulation with interactive play or exercise sessions, plus positive interactions with humans (grooming or stroking) may help to encourage
better sleep–wake cycles and thus reduce night waking.\textsuperscript{19} A caveat to this is that, for elderly cats with more advanced CDS, changing their environment and/or their routine may induce some considerable stress. This may lead to them displaying more severe CDS-like signs or other clinical signs associated with anxiety such as over-grooming, hiding, inappropriate urination or crying out at night.\textsuperscript{19,47,48}

For these cats, any environmental changes should be kept to a minimum and made slowly and with much reassurance. For cats more severely affected with CDS, great comfort can be found by providing them with all of their resources in one area or even one room.

In Figure 5, Phoebe has a low bed, a higher bed with steps to allow her to reach it, and her litter tray, food, water and toys all in one large room. Phoebe’s owner grooms her every morning and plays with her with a ball or with a catnip mouse on a rope whenever she initiates it. In Figure 6, Tin Tin has a choice of food bowls (one raised) and a choice of beds (one on a shelf by the window), all near his litter tray and all in one room. Tin Tin will go out in the garden if the weather is fine and if his owner is with him. Both cats in these examples have synthetic feline facial pheromone diffusers (Feliway Classic; CEVA) in the rooms where they spend the majority of their time.

For some cats, the signs of CDS become so severe that their quality of life is profoundly affected. When drug-intervention, diet, dietary supplements and environmental
enrichment are proving ineffective, and the cat's welfare is negatively affected by anxiety and confusion, then euthanasia should be considered.

Conclusions
Thankfully, in the majority of cases, veterinary professionals and owners can do much to support cats affected by CDS. Many cats live with clinical signs under control for several months and even years. Nurses and technicians should be fully informed about CDS in order to spot any behavioural indications and advise owners on beneficial interventions at an early stage. Senior health clinics offer an opportunity to identify affected cats by way of discussion or a questionnaire. Client education is vital to avoid dismissal of clinical signs of illness in older cats.

References
Ectoparasites 2: control of ectoparasites other than fleas

As well as fleas, cats may be infested with a number of other ectoparasites of clinical and zoonotic significance, yet they may be overlooked or treated inappropriately. Some of these are ubiquitous, such as the ear mite Otodectes cynotis; others, like ticks, are limited seasonally and geographically. Control of these parasites differs and is achieved through assessing the risk of ectoparasite infestation of individual patients, giving accurate advice and, as a result, ensuring good compliance and optimal treatment frequencies are achieved. The veterinary nurse and technician are uniquely placed to ensure these aspects of control take place and that programmes to control ectoparasites are successful.

Like flea control, control of other ectoparasites such as ticks, mites and lice relies on a knowledge of life cycles and prevention of breeding and transmission.

Ticks
Cats with access to the outdoors may become infested with ticks. Unlike fleas, ticks have a slow reproductive cycle and, with the exception of Rhipicephalus sanguineus, infestations are not established in the home. This, alongside the fastidious grooming habits of cats and their relative resistance to Lyme disease, has led to the perception that ticks are unimportant in cats. However, they can still be a significant cause of feline disease.

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Part 1 in this series on ectoparasites concentrated on flea control and appeared in the March 2016 issue (Ectoparasites 1: what a nurse needs to know about fleas. Feline Focus 2016; 2[3]: 85–91.)
**Back to basics**

**Box 1: Ticks and feline disease**

Ticks may cause:

- **irritation:** hypersensitivity to tick saliva may occur at the bite site leading to dermatitis and secondary infection. Ticks may also transmit bacteria directly (tick pyaemia);
- **anaemia:** because ticks are blood feeders, heavy infestation may lead to anaemia, particularly if left undetected or with mixed flea infestation;
- **vector-borne disease:** ticks may transmit a number of vector-borne diseases in cats. As well as possibly having a role in *Bartonella* species and *Mycoplasma haemofelis* transmission, they may also transmit Rickettsial diseases. Cats may be infected with *Babesia* species, with clinical signs only developing late on in the development of babesiosis-associated anaemia. In North America, the protozoa *Cyttauxzoon felis* may also be transmitted and infection is almost invariably fatal. Tick prevention remains the means of controlling these diseases in domestic cats;
- **tick paralysis:** *Ixodes holocyclus* may cause tick paralysis in cats living on the east coast of Australia, leading to potentially fatal respiratory compromise. (See Tick paralysis in cats. *Feline Focus* 2016; 2[2]: 35–42);
- **house infestation:** *R sanguineus* is capable of infesting houses, leading to increased risk of attachment to humans and zoonotic disease transmission.

**Figure 1:** Engorged *Ixodes* species ticks

**Treatment and prevention**

Physical removal and chemical prophylaxis form the basis of tick control.

The risk of tick-borne disease transmission increases the longer the tick is attached, so it is vitally important to remove ticks as soon as they are seen. Engorged ticks are often easily spotted (Figure 1) but observation of adult ticks in the axilla or groin, or smaller nymphs, may require a more thorough examination. This, ideally, should be performed at least every 24 h in the outdoor pet cat. For cats that spend long periods of time outdoors, this may be impractical. In these cats, owners should be encouraged to examine cats for ticks whenever the opportunity presents itself such as when grooming or stroking their pet.

Ticks should be removed with a tick hook (Figure 2) with a simple ‘twist and pull’ action. While instructions showing owners how to do this are often included with the tick hook, it should still be demonstrated to clients, because pulling straight upwards will result in mouthparts being left in the site of attachment. This increases the risk of disease and irritation. Nurses should also clearly demonstrate to clients what the tick looks like before and after attachment, as owners may attempt to remove skin masses, believing them to be ticks.

If a tick hook is not available, tweezers may be used. They should be fine tipped and it is important to grasp the head, as squeezing the tick will encourage it to regurgitate its stomach contents, accelerating disease transmission. Burning, freezing and application of paraffin to the tick are all also contraindicated as they will lead to regurgitation.
Removal of ticks within 24 h will significantly reduce disease transmission, but there is potential for transmission to occur earlier. As a result, chemoprophylaxis should be recommended in cats that are going outside and regularly picking up ticks. Pyrethroids and amitraz have formed the basis of chemical tick control in most domesticated species and this has hampered the development of tick treatments in cats as they are prone to pyrethroid and amitraz toxicity. Despite this, there are two useful alternatives. These are fipronil (which has limited activity against ticks) and a flumethrin/imidacloprid sustained release collar (Seresto; Bayer), which has high efficacy.

Environmental control is impractical in most cases as the reservoir of ticks is outside and they feed on wildlife hosts. The exception is *R sanguineus*, which may invade the home, requiring repeated insecticide treatments. Care must be taken when doing this with cats in the home and the whole house may need to be treated.

**Lice and mites**

Lice and mites may be transmitted from cat-to-cat by direct contact or may persist in the environment for short periods of time. Infestation with the biting louse *Felicola subrostratus*, *Cheyletiella* species fur mites or burrowing mites such as *Notoedres cati* and *Sarcoptes scabiei* will lead to alopecia, scurf and pruritus. *Cheyletiella* species adults and *F subrostratus* (Figure 3) can be easily detected on examination of fur combings and pluckings.

The eggs of both parasites (Figure 4) may also be detected attached to hair shafts. *Sarcoptes* species and *N cati* may be detected on skin scrapes, however, multiple scrapes are required and negative scrapes do not rule out the possibility of infection.

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**Figure 2:** A tick hook enables safe removal

**Key point**

Tick hooks are the preferred method of tick removal. Other methods such as the application of Vaseline, etc, are not recommended as they may cause regurgitation of the tick’s stomach contents, increasing the risk of disease transmission.

**Figure 3:** The biting louse *Felicola subrostratus*
Outbreaks of mites and lice occur where cats are in close association with each other, such as breeding establishments or colonies. If possible, affected animals should be isolated and all in-contact cats, as well as those exhibiting clinical signs, treated. Fipronil spray is particularly effective against lice and macrocyclic lactone spot-on preparations such as moxidectin, selamectin or eprinomectin are effective against mites.

There are three mites that require separate consideration for their control: *Otodectes cynotis* (the ear mite), *Demodex* species and *Trombicula autumnalis* (harvest mites).

**Otodectes cynotis**
As well as spot-on macrocyclic lactones, ear mites (Figure 5) require regular ear cleaning with topical ceruminolytic ear cleaners. Inflammation and secondary infections may require treatment with topical steroid, antibiotic and antifungal ear preparations. Topical ivermectin is also now available to apply directly into the ear canal.

**Demodex species**
Feline demodicosis is rare and, when it occurs, is mainly caused by *Demodex cati*. It is long and slender, whereas a less common species, *Demodex gatoi*, is short and broad. *Demodex* species mites are believed to be host-specific with minimal horizontal transmission. They live in the hair follicles and have a characteristic ‘cigar shape’ appearance. They are normal skin inhabitants and identification of single mites from hair plucking and skin scrapes does not necessarily indicate that clinical demodicosis is occurring. However, the presence of large numbers with concurrent skin lesions is strongly suggestive of clinical infection.

The localised form of demodicosis resolves spontaneously in most cats, whereas generalised demodicosis requires treatment. There is no licensed product for use in cases of feline demodicosis and amitraz is contraindicated. Macrocyclic lactones and lime sulphur dips have been reported to have some efficacy.

**Trombicula autumnalis**
Harvest mites are unusual in that the larvae are parasitic, but adults are free-living. The larvae are 0.2–0.3 mm in length and active in the late summer and autumn. Like ticks, the mites climb vegetation and will attach to any host, including cats.
Once attached, there is no transfer between hosts and feeding lasts for 5–7 days before detachment.

Feeding mites can cause foci of intense pruritus often found on areas of skin where pets contact vegetation, such as the head, face, legs and ventrum. The bright orange mites are visible to the naked eye (Figure 6) but may also be detected through hair plucking.

Control of the mites is difficult because of repeated exposure to environmental reservoirs of infection, but fipronil sprays have some efficacy in reducing the numbers attaching. As only the larval stages of this parasite are parasitic, environmental control is not required.

**Conclusions**

Cats may be infested with a variety of ectoparasites with differing geographical and seasonal distributions. By considering the risk of infestation and ensuring that adequate control measures are in place to prevent them, disease risks in pets and people are reduced and the human–animal bond strengthened. Veterinary nurses and technicians have an opportunity to spend time and share their expertise with clients, ensuring that successful control programmes with good compliance are put in place.

**Further reading**

- International Cat Care website. www.icatcare.org/advice/cat-health

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**Figure 6:** Harvest mites, *Trombicula autumnalis*, in the ear folds (picture courtesy of CVE Sydney University)

Control of the mites is difficult because of repeated exposure to environmental reservoirs of infection, but fipronil sprays have some efficacy in reducing the numbers attaching. As only the larval stages of this parasite are parasitic, environmental control is not required.

**Conclusions**

Cats may be infested with a variety of ectoparasites with differing geographical and seasonal distributions. By considering the risk of infestation and ensuring that adequate control measures are in place to prevent them, disease risks
Microchipping cats: are you doing all you can?

As part of our Keeping Cats Safe campaign, International Cat Care is asking veterinary nurses and technicians to promote microchipping.

In the UK, microchipping has recently become compulsory for dogs, following other countries such as Australia and many American states where this law also applies to cats. While the benefits of microchipping are clear, the uptake of microchipping in countries without legal enforcement remains low.

**Make the most of all microchipping opportunities:**
- **at neutering:** (as illustrated above) the perfect time to microchip under anaesthetic, and costs can be incorporated into the neuter fee;
- **at first or second vaccination appointments:** ensuring that cats are chipped well before they are allowed outside;
- **in nurse/technician consultations:** every cat can be routinely scanned and microchipping suggested if a chip is not detected;
- **microchipping drives:** offer low cost microchipping to clients with no microchip number recorded (also allows you to update your systems if the cat is chipped but the number is not recorded);
- **when working with unowned cats:** no cat should leave a homing centre without a chip.

**Benefits of microchipping:**
- identifying stray cats;
- evidence of ownership;
- compatible with microchip cat flaps and feeders;
- accurate identification, eg, for cats undergoing genetic tests for inherited conditions.

Encourage microchipping at every opportunity.
Managing stress in cats: single vs multi-cat housing – is it that simple?

Providing optimal welfare for cats should include consideration of whether they are housed singly or with other cats. A review of the scientific evidence suggests a range of factors, as well as individual attributes of each cat, that may influence which type of housing is associated with lower stress levels. For some cats, being housed singly may be less stressful, but this depends on their external environment as well as previous social experience with other cats. When cats are housed together, the dynamics of the group (such as relatedness, familiarity and group stability) affects levels of stress. For both singly and group housed cats, how predictable and stable their external environment is, as well as the nature of cat–human interactions, also impact upon stress.

When making decisions about complex issues, such as how best to house cats in order to manage their stress and provide optimal levels of welfare, it is important to consider the scientific evidence (where it is available). This article discusses research findings relevant to the housing of domestic cats both in homing centres (part 1) and in the home (part 2). It highlights various factors that may be important in relation to the stress levels experienced by cats housed in multi-cat environments, as well as those housed alone. Based on the evidence available, some ‘best practice’ guidelines focused around stress reduction are also provided.

Part 1: cats in the homing centre environment

Homing centres often operate at full capacity with limited resources. Communal housing of cats may thus provide a way to accommodate more cats. In addition, homing cats to existing multi-cat households may lead to a quicker cat ‘turn-around’, freeing up space for the new cats waiting to come in. However, certain cats may not cope well living in close proximity with other cats within a homing centre, or residing long-term in a multi-cat home after adoption.

Which type of housing is more stressful for cats in confined environments?

To try to answer this question a review of the relevant literature was carried out (see Finka et al 2014). While it was difficult to determine unequivocally whether single or multi-cat housing was more stressful for cats (due to various methodological limitations associated with many of the studies), the review was able to highlight several other factors which...
May be as (or possibly more) important than simply the number of other cats that an individual cat was housed with. For example, the studies reviewed suggested that:

- cats classed as unsocialised towards humans found homing centre environments more stressful than socialised cats;
- cats classed as unsocialised towards other cats found group housing more stressful than socialised cats;
- frequent disturbance during individual caging was more stressful than a stable group environment living with other familiar cats;
- cats housed alone in barren cages were more stressed and less likely to be adopted than cats that were housed in more enriched group housing and had consistent positive handling;
- living in a familiar established colony environment was less stressful than being housed (either individually or with other cats) in a novel cattery environment with frequent disturbance;
- large group housing with unfamiliar cats was more stressful for cats than individual housing or being housed with one or two other familiar cats.

Is relatedness important in group-housed cats?

A previous study comparing the interactions of cat pairs from the same household during confinement in a cattery found that littermates spent more time in contact with one another, and groomed and ate close to each other more often, than unrelated cats did (Figure 1). The authors of this study concluded that such greater affiliative behaviour between related individuals was due to the social ties that are developed between cats during the socialisation period (from 3–8 weeks old), which are then maintained when the cats remain living together into adulthood.

Additionally, another study found that both relatedness and familiarity were significantly associated with the frequency of close proximity to other cats as well as frequency of grooming.

How do we assess if a new cat will get on with other cats in an existing multi-cat home?

It can be very difficult to determine whether a cat may be able to live comfortably with other (often unfamiliar) cats because cat–cat relationships are potentially influenced by a range of factors that may be specific to the nature of a
particular environment (its resources) or the characteristics of a particular individual (age, temperament, etc). There are currently no reliable or valid tests that are able to predict cat–cat sociability. While homing centres may carry out some ‘cat testing’ (briefly placing two unfamiliar cats together and assessing their response to one another), this procedure may be very stressful for the individuals involved and potentially only provide information about how those specific two cats respond to each other in that specific context, on that particular day.

It is thus suggested that (if a cat is to be obtained from a homing centre) its potential suitability for multi-cat living may be better gauged (where possible) via information from previous owners in relation to the cat’s past social experiences, combined with observations of the cat’s general behaviour towards other cats in the homing centre over a period of time.

Additionally, gathering information from prospective owners in relation to the social dynamics within their current multi-cat household (the number of cats, amount and distribution of resources, and if the cats demonstrate affiliative or agonistic behaviours towards each other) may also help to determine whether the introduction of another cat may be suitable or not.

Lastly, providing lots of advice about careful cat–cat introductions and the provision/location of suitable resources within a multi-cat environment may also be particularly beneficial.

**Part 2: cats in the home environment**

In many cases, group living for cats within the home may be implemented under potentially suboptimal conditions (the cats may not be familiar with or related to one another and may vary in regards to their previous level of social experience with other cats). Such cats may, therefore, not necessarily form amicable relationships with one another. It is important that new cats are introduced carefully and that the general environment is managed in a way that helps to reduce stress and potential conflict between cats.

**How can we facilitate more amicable multi-cat relationships? Introducing cats**

See Box 1 for advice on introducing a cat to a multi-cat environment.

**In the longer term**

The following are suggested strategies to implement longer term within the multi-cat environment — these apply to both the indoor and outdoor environment:

- avoid resource-related conflict by ensuring that all resources are provided in abundance, are well placed, and have multiple points of access;
- provide security with multiple hiding places and suitable vertical space (eg, see Figures 2–5);
- enable cats to avoid each other if they wish by careful management of daily routines and of the...
Box 1: Introducing cats

The following are suggested strategies to implement during initial introductions:

- Ideally, introduce new and existing cats slowly over a period of time, settling the new cat into a room of its own, away from other cats.
- While cats are kept separately, ‘scent swapping’ between them can be performed so that their scents become familiar to one another gradually (creating a communal smell when the two are mixed). Use a natural cotton glove to gently stroke around the facial glands of one cat and then place this glove in an area the other cat has access to, letting them explore the scent on the glove in their own time. Treats can also be placed close to the glove to encourage positive associations with the new cat scent. Do this for both cats (a glove each) and swap the gloves over every few days.
- Using synthetic pheromones placed in a diffuser in key areas may also help the new cat to settle into the novel environment.
- Maintain a safe environment during the introduction process by providing physical barriers that initially facilitate visual and olfactory access only between cats.
- Observe the behaviour of the cats closely and only allow them physical access to one another when both appear comfortable during visual encounters.
- Ensure cats are introduced in an area where they can both get away quickly or hide, and are not forced to interact directly.
- Treats can be used to control the movements of cats during introductions so that the cats are initially encouraged (by being rewarded) to maintain a distance to one another, passively accepting the other’s presence rather than directly interacting.
- Cats should not be encouraged to eat meals next to one another (this is likely to be a behaviour that is preferably performed in solitary).
- Keep the existing cats’ routines and access to usual resources as normal/consistent as possible.

Figure 2: Cats in a multi-cat environment make use of a ‘cat tree’, which provides multiple raised areas as well as a hiding space (photograph courtesy of Rachel King)
relationships may fall in to several basic categories;

- **affiliative**: tail up approach, nose touch, allogrooming, allorubbing, play (initiated by both cats, not just the same cat each time),

- **tolerant**: avoidance, ‘time sharing’ of areas/resources, dividing the house into individual territories, ignoring each other or very few
interactions, not sleeping/resting together;
• **agonistic:** resource blocking, physical attacks, displacing, staring, growling, hissing.

**Multi-cat vs single: which type of housing is least stressful?**

There are limited studies that have compared single vs multi-cat households in relation to the stress it causes cats. However, the key findings from several relevant studies are summarised here.

In 2008, Lichtsteiner and Turner investigated the influence of single and group housing on basal urinary cortisol levels of indoor-only cats. The study found that cat-related parameters, such as the number of cats per household, area available for each cat, and number of persons per cat, did not have any significant influence on cortisol levels. However, human density and number of persons per household did correlate positively with cortisol levels.

In a more recent study by Ramos et al 2012, faecal glucocorticoid metabolites were compared between single and multi-cat households. Results indicated no significant differences between the two groups, but, within singly housed cats, glucocorticoid levels were higher with owners who were more socially active. Such results suggest that this increase in arousal might be due to more frequent/intrusive visits from unfamiliar people as well as general disturbance within the environment, potentially putting greater ‘social pressure’ on cats when housed individually.

Similar results were also found in a follow-on study by the same authors, where overall, no differences in metabolite levels were found between groups of cats housed individually, in pairs or in groups of 3–4. However, several other interesting findings were apparent. The study indicated that within larger groups of cats (ie, 3–4 cats per household) adult cats (≥2 years of age) had higher glucocorticoid levels than younger cats (<2 years of age), and adult cats in larger groups also had higher glucocorticoid levels than adults in single cat households. Additionally, the study also indicated that cats that ‘tolerated’ petting had higher glucocorticoid levels than cats that openly ‘disliked’ petting. Such results suggest that adult cats may
find living in groups with other cats more physiologically arousing (and thus potentially more stressful) than younger cats. Cats that do not enjoy petting but that stay and tolerate it, may also experience more ‘stress’ than those that may openly express their dislike and try to remove themselves from the interaction.

Some potential limitations of the current evidence:
The above findings suggest the importance of considering the role of humans as a source of potential stress for cats. While cat-related parameters generally did not appear to affect levels of arousal in cats (apart from older cats that were found to have higher arousal levels when in multi-age groups), there are some potential limitations associated with the studies that are worth considering:
• In all studies ‘stress’ was measured via physiological measures, as such providing indication of physiological stress/arousal only. Thus, we cannot necessarily assume anything about the emotional wellbeing of the individuals concerned.
• Other potentially important factors including the specific nature of cat-cat interactions (ie, affiliative, tolerant, agonistic), cat relatedness/familiarity and features within the physical environment (such as the number and distribution of resources) were not measured.

Conclusions: how can we make the lives of domestic cats better and reduce their potential stress?
The current evidence suggests that environmental disturbance/manipulation, as well as the attributes of the individual cats and the nature of cat-human interactions may all potentially be as, if not more, important factors than simply the housing style under which domestic cats are kept (ie, single vs multi-cat).
Based on the available evidence, it is thus suggested that the general principles described in Box 2 be considered important in managing the stress levels of individuals.

References

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