State of the art
Advanced life support

Clinical nursing
Approach to pruritic conditions

A closer look at...
Urine microscopic examination

Behaviour
Meeting feline welfare needs

The International Society of Feline Medicine
Journal for Veterinary Nurses and Technicians

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Welcome to our August edition of *Feline Focus*. This edition has a variety of articles that we hope you find interesting and practical. We complete several article series, starting with Simon Tappin’s second article on cardiopulmonary resuscitation with more information on drug treatment and post-arrest management. Next is part 2 of our ‘itchy cat’ articles, with Sophie Tyler focusing on diagnostic tests and treatment. Our urinalysis series concludes with urine microscopy, with some great photos to illustrate another useful article. We finish with Anne Fawcett’s article on feline environmental needs. This article has some fabulous examples of modifications to make cats more comfortable, many of which your clients may never have thought of, but could consider in their home.

Do remember our monthly webinars, which cover a range of topics — if you have missed any, we record them all and have a bank of them available on our website. Why not have a look and register for the next one!

Best wishes,

Sam Taylor, Veterinary Editor

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*Source: Mills 2001. Evaluation of a novel method for delivering a synthetic analogue of feline facial pheromone (Feliway®) to control urine spraying by cats.

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Effective cardiopulmonary resuscitation 2: advanced life support

When effective basic life support (airway, breathing and circulation) is in place, cardiopulmonary resuscitation (CPR) can move on to advanced steps. An electrocardiogram (ECG) allows determination of the arrest rhythm, which will guide the choice of drugs to use first during CPR, a choice is then made to either give adrenaline (giving vasoconstriction and an increased heart rate) or atropine (increases heart rate through removing the slowing effect of the vagal nerve). Ventricular fibrillation is treated either with electrical defibrillation or a mechanical pre-cordial thump. If there is no return of spontaneous circulation after 10–15 mins of CPR, further attempts are likely futile. Careful patient management is needed post-arrest to minimise the risk of a second episode.

Once effective basic life support is established, more advanced and specific treatment, such as drugs and defibrillation, can be considered to restore spontaneous circulation or to correct the underlying cause of the CPR. If possible, an ECG should be placed as soon as possible after cardiopulmonary arrest (CPA) as it will allow identification of the underlying arrest rhythm and dictate drug therapy.

Arrest rhythms
In small animals the most common arrest rhythms are:

- **asystole**: most commonly seen in traumatised, hypoxic or anaesthetised patients. It carries a poor prognosis but should be treated with aggressive CPR and adrenaline;

- **pulsless electrical activity (PEA)**: (previously known as electromechanical dissociation [EMD]) occurs when the ECG records normal electrical activity within the heart but that there is little or no myocardial contractility. Anaesthetic overdose, acute hypoxia, acidosis, toxicity and cardiogenic shock are potential causes of PEA. Again, treatment with CPR and adrenaline is recommended;

- **ventricular fibrillation**: much less common as an arrest rhythm in small animals in comparison to man, in whom it occurs in about two-thirds of CPA events.
Ventricular fibrillation leads to random activity within the ventricles, thus producing no propulsive ventricular contraction and limited cardiac output. Ventricular fibrillation can only be distinguished from PEA by observation of an ECG. Effective treatment requires defibrillation, which is best applied electrically via a defibrillator (Figure 1). This requires specialist training and equipment, which is not readily available. Alternatively, mechanical defibrillation in the form of a forceful precordial thump over the heart base may mechanically shock the myocardium back to a perfusive rhythm.

**Drug treatment**
Drugs form an essential part of advanced life support and can be given by a number of routes. Central venous access offers the quickest access to the central circulation. If a jugular catheter is in place this is the best route for drug administration. Peripheral venous access is adequate, although it is important to ensure that drug administration is followed by a large volume flush to move the drug into the central circulation. The intra-osseous uptake of drugs and fluids is very rapid and placement of an interosseous needle is relatively straight forward. These can be easier to place than a peripheral catheter in a patient with poor perfusion, especially if the patient is moving while chest compressions are being performed.

If there is no venous or interosseous access (or while it is being achieved) then drugs (with the exception of bicarbonate) may be administered via the endotracheal tube. A canine urinary catheter is placed into the airway, through the endotracheal tube, to a level just beyond the tracheal bifurcation. Dosages of drugs should be doubled if this route is used and followed by a large ventilation; this helps move the drug into the alveoli, allowing uptake into the pulmonary circulation.

Where possible, drugs such as adrenaline (epinephrine) and
atropine are kept drawn up in the crash-box in doses appropriate for 10 kg patients (see Table 1), with a half-dose therefore used for the average sized 5 kg cat. This avoids the need for calculation and preparation of these drugs during stressful CPR situations and appropriate doses can be given rapidly (Figure 2). There are no fixed guidelines for the stability and sterility of drugs once drawn up into syringes; however, replacing them every 2–4 weeks is generally recommended.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>5 kg cat</th>
<th>10 kg cat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline (low dose)</td>
<td>0.01 mg/kg</td>
<td>0.5 ml</td>
<td>1 ml</td>
</tr>
<tr>
<td>1:10000 (0.1 mg/ml)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adrenaline (high dose)</td>
<td>0.1 mg/kg</td>
<td>0.5 ml</td>
<td>1 ml</td>
</tr>
<tr>
<td>1:1000 (1 mg/ml)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atropine (0.6 mg/ml)</td>
<td>0.04 mg/kg</td>
<td>0.3 ml</td>
<td>0.7 ml</td>
</tr>
<tr>
<td>Vasopressin (20 IU/ml)</td>
<td>0.8 IU/kg</td>
<td>0.2 ml</td>
<td>0.4 ml</td>
</tr>
<tr>
<td>Lidocaine (20 mg/ml)</td>
<td>2 mg/kg</td>
<td>0.5 ml</td>
<td>1 ml</td>
</tr>
<tr>
<td>Bicarbonate (1 mEq/ml)</td>
<td>1 mEq/kg</td>
<td>5 ml</td>
<td>10 ml</td>
</tr>
<tr>
<td>(1 mEq/ml)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Quick reference table for feline CPR drugs

Adrenaline acts on α-adrenergic receptors, causing peripheral vasoconstriction, increasing blood pressure and blood flow to the head, and β-adrenergic receptors increasing heart rate and contractility. Adrenaline is recommended for the initial treatment of asystole and PEA, with repeated dosing every 3–5 mins through the CPR attempt suggested. In human medicine there is controversy as to whether high (0.1 mg/kg) or low (0.01 mg/kg) dose adrenaline is superior. High dose adrenaline is associated with better short-term outcomes; however, it increases myocardial oxygen demand, which is detrimental when oxygen delivery is limited during, and immediately after, a CPA. There is, however, no conclusive evidence to support this in veterinary patients. In general, low dose adrenaline is suggested in the first instance, moving to high doses if there is a lack of response.

Vasopressin has a similar action to adrenaline in that it acts on V receptors to cause vasoconstriction, independent of the α-adrenergic receptors triggered by adrenaline. In an acidotic environment (common in an arrest situation) the α-adrenergic receptors become less responsive,
which is not the case for the V1 receptors triggered by vasopressin. As a result of this effect and its lack of effects on the heart, there has been much interest in vasopressin as an arrest drug. There is limited evidence that it may be advantageous to use vasopressin over adrenaline. It can be given every 3–5 mins during a CPR attempt either in place of, or as well as, adrenaline.

Atropine is a vagolytic drug and a single dose of 0.04 mg/kg is used to treat sinus bradycardia, third degree atrioventricular (AV) block or increased vagal tone. There is limited evidence to support its efficacy in other situations. Cautious dosing is advised as it can cause a marked rebound tachycardia that will increase myocardial oxygen demand. High dose atropine has been associated with worse outcomes as a result.

Many other drugs are useful in specific circumstances, such as lidocaine for management of post-resuscitation ventricular tachycardia, sodium bicarbonate for severe metabolic acidosis and specific anaesthetic antagonists. Once heart rate and rhythm and a peripheral pulse have been restored, arterial blood flow may be maintained with dopamine.

Monitoring resuscitation
During CPR one team member is responsible for monitoring the effectiveness of the resuscitation attempt and for the return of spontaneous circulation. ECG monitoring should always be used if available. Palpation of the femoral pulse is a routine technique for monitoring forward blood flow, but can be misleading as compression can generate venous pulses due to back flow of blood in the caudal vena cava. If available, a Doppler blood pressure probe placed on the lubricated surface of the eye can detect retinal blood flow. If retinal blood flow is present, it suggests adequate cerebral perfusion should be present. Monitoring should also continue for other signs of effective circulation such as improvement in mucous membrane colour, a reduction in capillary refill time and a reduction in pupil size. The use of pulse oximetry should be avoided as pulsatile blood flow is usually inadequate during CPR.

Measurement of end tidal (ET)CO$_2$ with a capnograph provides useful information. A progressive increase in ETCO$_2$ reflects the success of ventilation in moving of CO$_2$ from peripheral tissues to the lungs and out of the body in the course of the resuscitation attempt. There is no consensus as to ETCO$_2$ values for end points for resuscitation in veterinary medicine. However documenting a reliable trace
is a good indicator of successful perfusion and values >20mmHg for cats have been associated with an increased rate of return of spontaneous circulation. Ventilation should not cease immediately on return of spontaneous respiration but continue as required until the patient regains consciousness.

**Post resuscitation**
If the patient is successfully resuscitated, then close monitoring is essential as many animals will suffer second arrests. Particular care should be paid to oxygenation, ventilation, blood pressure and perfusion status, to avoid complications such as pulmonary oedema, renal failure and disseminated intravascular coagulation. As increases in body temperature will increase tissue oxygen demands, a more cautious warming procedure is usually considered compared with other circumstances (for example, post anaesthesia), with an increase of 0.25–0.5°C/h suggested and rates >1°C/h avoided.

It is very common for neurological abnormalities, such as blindness and proprioceptive deficits, to be present after CPA. These may not become obvious immediately but develop over 12 h, are to be expected and usually resolve after 48–72 h. Glucocorticoids should not be administered to these patients as they may worsen outcome by causing hyperglycaemia.

**Further reading**
This guide is designed to help veterinary professionals better understand, prevent and manage stress and distress in cats.

The 160-page guide has been broken down into twelve easily digestible chapters, covering what stress and distress are, why cats can become stressed and/or distressed, and how this impacts on the behaviour and health of the cat. The guide looks at the causes of stress and distress in different environments, including the veterinary clinic, homing centres, at home and in multi-cat households, and how it can be prevented and managed.

This practical guide provides some basic ideas, principles and tips which can be implemented by all veterinary professionals, and will make a huge difference to the cats in your care.

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An essential guide to understanding, preventing and managing feline stress to improve the health and wellbeing of the cats in your care
The itchy cat 2: approach and management of pruritic conditions

Several diagnostic steps should be performed when investigating a cat with pruritus which range from ruling out ectoparasites to more lengthy investigations including a diet trial. Treatment can be as simple as strict ectoparasite control in cats with a flea burden or controlling diet in those cats with cutaneous adverse food reaction. Non-flea, non-food feline hypersensitivity (atopic dermatitis) is a diagnosis of exclusion. Management options include glucocorticoids, ciclosporin, allergen specific immunotherapy, antihistamines and essential fatty acids. Bacterial skin infection (pyoderm) and ringworm (dermatophytosis) may cause pruritus to some degree and this needs to be considered in addition to antimicrobial and antifungal treatment, respectively.

Many of the dermatological lesions that are seen in pruritic cats can be a manifestation of an allergic reaction to fleas, food or environmental allergens (non-flea, non-food induced feline hypersensitivity dermatitis). They can include a variety of cutaneous reaction patterns mentioned in Part 1. It is therefore important that diagnostic steps are performed in a logical process (see Box 1). Many tests can be performed when faced with a pruritic cat. Readers are advised to consult a dermatology text book for more details on how to perform skin scrapes and skin cytology. Diagnostic tests for fleas, Cheyletiella species and dermatophytosis will be discussed here. Skin disease due to mites such as Demodex and Notoedres species is rare and will not be considered here.

1 Rule out parasites
Fleas
If fleas or flea dirt cannot be seen with the naked eye further investigations can be performed.

Coat brushing
Coat brushing is much more sensitive than a wet paper test. It is used to look for flea dirt (and also for Cheyletiella mites and their eggs). Lice may also be found using this technique although they are generally uncommon given the widespread use of flea products.
• The cat is brushed over a table top or piece of paper.
• The material is collected using a microscope slide. After removing the excess hair, collect the sample using a piece of adhesive tape and stick this on to the microscope slide (see Figure 1).
• The sample is examined using a low-power objective (×4 or ×10). Flea dirt (Figure 2) or Cheyletiella mites and their eggs may be seen (Figures 3 and 4).

**Ear mites** *(Otodectes cynotis)*

In cats presenting with signs of ear irritation and otitis where there is a large quantity of aural exudate, a cerumen smear can be performed.
• A sample of exudate is obtained in a gentle manner from the vertical ear canal using a cotton bud.
• This is mixed on a glass slide with paraffin oil, and a cover slip applied.
• The slide is examined under low power (×4 or ×10) objective. Adult mites or eggs can be seen under the microscope (Figure 5).

**2 Rule out infection**

**Bacterial and yeast infection**

For more information on how to use the microscope and cytological findings please consult a dermatology or laboratory text.
• Scotch clear adhesive tape can be used to gently press over the skin.
• The tape is then attached to a
Box 1: The approach to a cat with pruritus

**Cat presents with pruritus**

**Step 1: rule out parasites**
- Perform a coat brushing to look for evidence of fleas. *Cheyletiella* mites can also be detected (rare)
- Skin scrapes can also be used to detect mites. In cats presenting with aural pruritus, otoscopy should be performed ± a cerumen smear examination

**Step 2: rule out infection**
- Cytology should be performed to rule out bacterial or yeast infection
- If cytology suggests bacterial or yeast infection, treat infection. If fungal culture positive, treat for dermatophytosis
- A fungal culture should be performed to rule out dermatophytosis, MacKenzie toothbrush sampling can be useful. Hair plucks can also be examined

**Step 3: rule out cutaneous adverse food reaction**
- If there is resolution of pruritus, then re-challenge with the original diet. If signs recur within 2 weeks of feeding the original diet, and resolve when the exclusion diet is fed once more, a diagnosis of cutaneous adverse food reaction can be made
- If there is no improvement in pruritus in a cat with compatible history and clinical signs, non-flea, non-food induced feline hypersensitivity dermatitis can be diagnosed. If the client wishes to pursue immunotherapy, allergen testing can be performed
- If there is no evidence of infection or if pruritus persists despite treatment, rule out cutaneous adverse food reaction by performing a dietary trial
microscopic slide in a loop shape so that the sticky side containing the sample is facing up and away from the slide.
- The sample is stained using Diff-Quik.
- The sample is rinsed with water.
- The loop of tape is then upwrapped and the sticky side is stuck down to the glass slide and dried with paper towel.
- The sample can then be examined using the oil immersion lens.

(See Step-by-step guide to taking an adhesive tape strip sample. *Feline Focus* 2017; 3[7]: 195–197.)

**Dermatophytosis**
Consider investigation for dermatophytosis if there is a poor response to symptomatic therapy (eg, with ectoparasite control and prednisolone) or if owners or in-contact animals have skin lesions.

**Tip**
It is important to wear gloves and thoroughly disinfect the examination space after examining patients with suspected dermatophytosis.

**Wood’s lamp examination**
This is a useful tool in looking for dermatophytosis due to *Microsporum canis* because many isolates will fluoresce.
- The lamp should be used in a darkened room, allowing adequate time for your eye to adapt to the light before using the lamp.
- The lamp is held close to the hair and skin and the entire coat should be examined.
- Apple green fluorescence of the hairs is a positive result that may mean that *M canis* is present, not the scale and crust.

**MacKenzie toothbrush sampling**
As a negative Wood’s lamp examination cannot exclude dermatophytosis in cats (some isolates will not fluoresce), hair, scale and crust (or toothbrush) samples can be submitted to an external laboratory for fungal culture.
- A sterile toothbrush is gently brushed through the cat’s coat and focal lesions (many cats enjoy this!) collecting hair and debris (Figure 6).
- The toothbrush is then placed into a sterile packet (either back into the toothbrush packet or into an autoclave pouch).

**Hair plucks**
Hair plucks are useful when there is evidence of alopecia or hair loss.
- Hair plucks are taken using artery forceps.
- The hairs are placed in liquid paraffin trying to ensure that the hairs lie in the same direction.
- A cover slip is placed on top.
- The slide is examined under ×4 or ×10 objective.
- A rough or dirty looking hair with uneven edges may be suggestive of dermatophytosis. Fungal ectothrix spores may be seen if
the total magnification is increased to ×40. Note: this takes considerable practice.

For more information see Dermatophytosis in cats: treatment and decontamination. Feline Focus 2017; 3(7): 181–188.

3 Rule out cutaneous adverse food reaction

Dietary trial
Perform a dietary trial to rule out cutaneous adverse food reaction. A dietary trial should be conducted for a minimum of 8 weeks using a novel protein and carbohydrate source to which the cat has not been previously exposed. A thorough dietary history is essential to determine the best choice of diet; if a cat normally eats wet food, this should be chosen for the dietary trial.

Client and cat compliance is essential and palatability is crucial. For home-cooked diets, supplements do not need to be added during the period of the elimination diet trial, although balancing the diet is essential long term. If the patient does not like the new diet, it is important to change to a different type as soon as possible to avoid the cat starving itself and causing problems such as hepatic lipidosis. Improvement during the diet trial supports a tentative diagnosis of cutaneous adverse food reaction, and the diet should therefore be continued. The diagnosis is confirmed if the pruritus returns when performing a dietary re-challenge with the old diet.

4 Allergen testing

Allergen testing should only be performed when other causes of pruritus have been ruled out and the owner wishes to pursue allergen specific immunotherapy (these are not diagnostic tests) with the aim of desensitisation. Testing may include allergen-specific IgE serology and/or intradermal methods.

Management of the pruritic cat

Ectoparasite control
Ensure adequate ectoparasite control and perform a therapeutic flea control trial.

There are many ectoparasite control products available. It is important to show owners how to apply or administer them to their cat (many cats dislike having a topical product applied) or how to give an oral tablet if an oral ectoparasite control is prescribed. The International Cat Care website has useful videos for clients (https://icatcare.org/advice/videos).

Key point

Eliminating fleas from the environment is a vital part of ectoparasite control. Use of an environmental ectoparasite control product, vacuuming and washing bedding is recommended.

To ensure integrated flea control, it is important to:
• Eliminate existing fleas on the cat and other animals within the household (ensure that all animals receive regular ectoparasite control).
• Eliminate fleas from the environment (use of an environmental ectoparasite control product). Vacuuming and washing bedding on a hot cycle will also help environmental decontamination.
Clinical nursing

- Prevent subsequent flea infestation (ensure continued flea control).
- If Otodectes cynotis infestation is diagnosed, ectoparasite control that has activity against these parasites should be applied. This may include topical ear medication to kill the mites and treat the otitis externa.

**Treating infection**

It is important that secondary infections such as bacterial pyoderma and Malassezia dermatitis are managed appropriately. The presence of concurrent infection may make other treatments such as ectoparasite control and a dietary trial less effective.

- **bacterial skin infection** (pyoderma): this usually occurs secondary to an underlying skin disease (most commonly allergic skin disease). A 3 week course of antimicrobial therapy is required (longer for some cases) and response to treatment should be monitored closely. Treatment should continue for at least 7 days past resolution of clinical signs.

- **dermatophytosis**: this is managed using systemic treatment. Itraconazole is the only licensed systemic treatment. Specimens for fungal culture should be obtained from all in-contact cats. Decontaminating the environment is very important. Hair should be removed by vacuuming and surfaces should be disinfected using a product containing bleach. Contaminated bedding should be destroyed. Fungal culture should be performed every 4 weeks and treatment should be continued for at least another 2 weeks after negative culture. A 2% miconazole + 2% chlorhexidine shampoo (Malaseb) can also be used to help control dermatophytosis, although many owners will find twice weekly bathing of their cat very challenging.

**Diet**

If there is improvement during the diet trial it supports a tentative diagnosis of cutaneous adverse food reaction. The diagnosis is confirmed if the pruritus returns when performing a dietary re-challenge with the old diet, in which case the novel protein or hypoallergenic diet should be continued. If the owner wishes to identify the specific component that cat is allergic to, each item needs to be added to the diet for a 2 week period without a reaction being observed before deciding whether the new food component is tolerated.

**Key point**

There are some more unusual dermatological lesions that can cause pruritus in cats which will not be due to ectoparasites, infection or allergies. These include immune-mediated skin disease and neoplasia, among others. A biopsy is required to diagnose these diseases.

**Allergen specific immunotherapy**

Gradually increased quantities of allergen extract are administered using subcutaneous injections in the hope of reducing signs after exposure to the offending allergen(s). Treatment should be trialled for up to 12 months because it can take a long time for the full benefits to be seen; antipruritic therapy is, therefore, usually given concurrently during the initial stages of this therapy.
Corticosteroids

Corticosteroids (e.g., prednisolone) are used daily for 10–14 days then reduced to alternate day therapy. Depot preparations should only be used as a last resort as the medication cannot be withdrawn if adverse side effects are seen. It is advisable to monitor blood glucose before commencing and throughout treatment as diabetes is a potential side effect. There are many food products available for cats that are great for disguising tablets, such as Webbox, so that injectable preparations are not required.

Ciclosporin

Although ciclosporin can be a very effective treatment in cats with allergic skin disease, side effects can be seen, including vomiting, weight loss, anorexia and diarrhoea. It can exacerbate feline herpesvirus (FHV-1) infection in previously infected cats and can (but rarely) be a concern for cats exposed to Toxoplasma gondii.

Antihistamines

These are not licensed for use in cats but can be a useful tool in reducing pruritus with less serious side effects. Examples include cetirizine and chlorphenamine.

Essential fatty acids

A synergistic effect can be seen when essential fatty acids are used alongside glucocorticoids and antihistamines.

Conclusions

Cats may be pruritic for several reasons. If these cases are approached in a logical step-by-step fashion, the underlying cause can often be determined. Owner communication is very important when discussing the approach to pruritus and regular re-examinations with veterinary surgeons and nurses are crucial. Nurses are often invaluable in discussing effective ectoparasite control, how to perform dietary trials appropriately and will often administer immunotherapy vaccinations in patients that are receiving desensitisation.

Further reading

Lethal lilies

Eating any part of the lily – flowers, leaves, stem or pollen – is EXTREMELY DANGEROUS TO CATS and can cause kidney damage and even death.

IF YOU THINK YOUR CAT HAS EATEN ANY PART OF A LILY, CONTACT YOUR VET IMMEDIATELY.
Urine microscopic examination 2: cells, casts, crystals and ‘creatures’

Urine microscopy is an important part of complete urinalysis. Epithelial cells may be found in low numbers in normal urine, although large numbers should be investigated and dysplastic cells distinguished from neoplastic cells. Red and white blood cell appearance may be affected by storage and urine specific gravity. Casts and microorganisms may be observed, and to establish the significance of crystals, urine should be examined promptly to avoid artefactual crystalluria.

Insoluble particles within feline urine include cells (epithelial cells, red blood cells [RBCs], white blood cells [WBCs] and neoplastic cells), casts, microorganisms, crystals, lipid droplets, spermatozoa (gender specific), mucin and artefacts. Some insoluble particles are more difficult to identify in wet preparations of urine than in air-dried blood or cytology smears, as these particles may be subjected to varying periods of exposure to osmotic changes, pH changes and bacterial toxins, with resultant changes in their size, structure and transparency.

Cells

Epithelial cells
Epithelial cells can be found in low numbers in the urine sediment of healthy cats because they are constantly exfoliating into the urinary tract lumen as they are replaced by new cells. Accurate data regarding the number of epithelial cells normally present in the urine of cats is not available.

Three main types of epithelial cells may be found in urine, depending on their origin along the urinary tract — renal, transitional and squamous (see box). Some laboratories report these epithelial cell populations separately. However, this is often problematic on wet preparations, particularly as urine...
A closer look at...

Types of epithelia\(^2\)\(^-\)\(^4\)

**Renal epithelial cells:**
- derived from the renal tubules;
- small round cells (in suspension), usually degenerate, indistinguishable from leukocytes or small transitional cells in unstained wet smears;
- when stained, nucleus is round and centrally positioned;
- cytoplasm is granular and may contain a few vacuoles;
- only reliable as indicators of renal disease when incorporated into casts.

**Transitional epithelial cells (urothelial cells):**
- line the urinary tract from the renal pelvis to approximately the distal portion of the urethra;
- medium-sized cells with a moderately high nucleus to cytoplasm ratio;
- typically granular cytoplasm;
- increased numbers may be present with inflammatory disorders and neoplasia (especially transitional cell carcinoma [TCC]); and may also be associated with traumatic catheterisation technique.

**Squamous epithelial cells:**
- line the distal urethra, vagina, vulva or prepuce;
- largest cells in the urine;
- large flat cells with a single nucleus and abundant cytoplasm;
- most often found in voided samples or with catheterisation;
- usually of little or no pathological significance.

samples sent to the laboratory are invariably not fresh. Consequently, all epithelial cell types may be counted under the one general epithelial cell category. A high total epithelial cell count (usually enumerated as a range or mean of epithelial cells seen per high power field [HPF]) on wet-preparation examination should prompt closer cytological assessment of the epithelial cell component. For this purpose, a stained air-dried urine smear is often required to help differentiate between malignant, dysplastic and hyperplastic epithelial cells (the latter two cell types being common in urine from animals with cystitis and reactive hyperplasia).

**Erythrocytes (RBCs)**

Erythrocytes tend to be the smallest cellular constituents in urine when they are present (Figure 1). Their appearance may be affected by urine specific gravity (USG) and urine pH\(^1\)\(^,\)\(^2\):
- if USG is 1.010–1.020, RBCs appear small (approximately half the size of WBCs), round, uniform in size, moderately refractile, and pale yellow to orange in colour;
- if urine is concentrated, RBCs can become crenated and appear granular;
- in hypotonic (especially if USG <1.006) or alkaline urine, RBCs swell, appear as balloons (with smooth edges and pale yellow cytoplasm) or colourless rings (ghost or shadow cells), or completely lyse. Osmotic lysis of erythrocytes can be complete within 2 h.

**Leukocytes (WBCs)**

Leukocytes in fresh urine generally appear as round cells with granular cytoplasm (Figure 1), intermediate in size between RBCs and transitional epithelial cells. However, their appearance may be affected by a number of factors\(^1\)\(^,\)\(^2\):
- nuclei may or may not be discernible using reduced concentration.
illumination, bright-field microscopy but can be readily demonstrated in stained smears;
• crenation or swelling depends on USG and urine pH;
• if kept at room temperature for an hour or longer, leukocytes may appear degenerate with foamy cytoplasm and mild karyorrhexis, pyknosis or karyolysis;
• up to 50% of WBCs may lyse within an hour at room temperature in alkaline dilute urine;
• WBC numbers may be underestimated in smears if the WBCs are clumped.

Neoplastic cells
Neoplastic cells are rarely detectable on routine wet-preparation urine sediment examination. Swelling and degeneration of cells can mimic malignancy, particularly when fresh urine samples have not been used. If exclusion of neoplasia in the urinary tract is required, a wet-preparation sediment or, preferably, several air-dried smears must be prepared for examination from freshly formed urine (ie, not the first morning sample) immediately after centrifugation. Air-dried smears can be stained with a rapid Romanowsky stain and assessed more closely for the presence of cytological criteria of malignancy.

Difficulties may be encountered when trying to differentiate hyperplastic, dysplastic and neoplastic changes within epithelial cells — particularly in the presence of significant inflammation and/or infection. In these instances, it would be prudent to refer the slides to an experienced veterinary cytopathologist for examination.

Casts
Casts are elongate, parallel-walled structures that form in the acidic and concentrated luminal environment of the ascending limb of the loop of Henle, distal renal tubules and collecting ducts. They are cylindrical moulds of the renal tubules formed on a matrix of Tamm–Horsfall mucoproteins secreted by the epithelial cells lining these tubules and ducts. RBCs, WBCs, epithelial cells, haemoglobin, myoglobin, lipid or bilirubin may be incorporated during their formation.

Ideally, cast examination should be performed on unpreserved urine immediately after collection. If chemicals (eg, formalin) are used to preserve cast morphology, this should be noted on the laboratory submission form. Use of supravital stains may aid in the correct
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identification of casts, which can be difficult in unstained smears.\textsuperscript{1,2} Several types of casts may be identified on routine wet-prep urine sediment examination. These structures are classified according to their appearance, which reflects their content:\textsuperscript{1–3}

- **hyaline casts**: are primarily composed of Tamm–Horsfall mucoproteins. They are difficult to see, dissolve rapidly in dilute or alkaline urine and are commonly found with renal diseases associated with proteinuria.
- **cellular casts**: include WBC, RBC and epithelial cell casts. The presence of WBC casts should prompt urine culture. It can be difficult to distinguish WBC casts from epithelial cell casts. However, epithelial cell casts contain highly refractile tubular epithelial cells that have not yet disintegrated. A popular but unproven hypothesis is that renal tubular epithelial cell, fatty, granular and waxy casts represent different stages of degeneration of epithelial cells in casts.
- **fatty casts**: contain many small, round, highly refractile lipid droplets.
- **granular casts**: are produced once cells degenerate; casts may take on a coarse granular appearance or, with more degeneration, a fine granular appearance.
- **waxy casts**: represent the final stage of degeneration of granular casts and are relatively stable.
- **pigmented casts**: include haemoglobin (yellow–brown) and myoglobin (red–brown) casts.

**Microorganisms**

**Bacteria**

Detection of bacteria in the urine (bacteriuria) depends on the skill and experience of the observer and the numbers present. More than $10^4$ bacterial rods/ml or $10^5$ bacterial rods/ml indicates bacteriuria.

**Significance of casts in feline urine (cylindruria)\textsuperscript{1,3}**

Increased numbers of casts in urine indicate pathology at the level of the renal tubules or collecting ducts:

- cast numbers do not reliably correlate with the degree of pathology at the level of the renal tubules or collecting ducts;
- hyaline casts in increased numbers may be seen in animals with glomerular proteinuria;
- epithelial casts suggest active tubular degeneration or necrosis (eg, gentamicin induced);
- granular casts result from cellular degeneration and increased numbers reflect tubular degeneration, necrosis and/or inflammation;
- erythrocyte casts indicate glomerular or tubular haemorrhage;
- leukocyte casts reflect inflammation involving renal tubules (eg, pyelonephritis);
- waxy casts suggest chronic renal pathology and intrarenal stasis;
- haemoglobin and myoglobin casts may be seen with haemoglobinuria and myoglobinuria, respectively;
- large numbers of casts indicate the presence of active renal disease/damage.

**Of particular note:**

- fatty casts are the most common type of casts in cats due to the physiological storage of lipid in feline tubular epithelial cells; increased numbers are seen in cases of nephrotic syndrome and diabetes mellitus;
- occasional hyaline and granular casts per low power field are considered normal;
- no cellular casts should be observed in sediment from normal cat urine.
cocci/ml need to be present before they can be readily detected in the unstained sediment. Bacteriuria is not a finding in healthy cats. It was also thought to be rare in idiopathic feline lower urinary tract disease, although two studies have challenged this notion — with bacteriuria detected in 22% of catheterised samples in one and 23% of cystocentesis samples in the other. Bacterial urinary tract infections are more common in older cats. Pyuria should not be a criterion for determining the presence or absence of bacteriuria.

If examining wet preparations of urine sediment, this should be performed under low light intensity to increase contrast. Bacteria usually refract light, and bob and quiver in the sediment. Single cocci are difficult to detect. Coliform rods may form chains, which need to be distinguished from fungal hyphae (air-dried smears allow differentiation). Stained wet preparations have been shown to have an unacceptably high false-positive rate for bacteria.

**Table 1: Factors that may affect detection of bacteria during microscopic examination of urine sediment preparations**

<table>
<thead>
<tr>
<th>False positives — causes</th>
<th>False negatives — causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample contamination during collection, centrifugation or staining</td>
<td>Small numbers of bacteria</td>
</tr>
<tr>
<td>Allowing urine to stand at room temperature for longer than 2 h</td>
<td>Recent antibiotic therapy</td>
</tr>
<tr>
<td>Misidentification of bacteria in urine sediment</td>
<td>Diuresis/dilute sample</td>
</tr>
<tr>
<td></td>
<td>Intermittent shedding of bacteria</td>
</tr>
</tbody>
</table>

**Table 2: Factors that may affect culture of samples in which bacteriuria is correctly identified or ruled out on microscopy**

<table>
<thead>
<tr>
<th>Negative culture with bacteriuria</th>
<th>Positive culture with no bacteriuria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-viable bacteria in urine at time of collection fail to be cultured due to antimicrobial drug effects</td>
<td>Small numbers of bacteria</td>
</tr>
<tr>
<td>Sample contamination with oxidants (eg, bleach)</td>
<td></td>
</tr>
<tr>
<td>Death of fastidious bacteria between time of sample collection and urine culture. For culture, there is no significant change in refrigerated samples for up to 6 h; however, &gt;6 h can result in false-negative cultures</td>
<td></td>
</tr>
<tr>
<td>Chemical preservation of urine sample</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: (a,b) Air-dried cytospin smear of urine from a cat with an *Escherichia coli* urinary tract infection. Note the short bacterial rods, located both intra- and extracellularly, accompanied by numerous degenerating neutrophils. Urine was obtained by cystocentesis and the smear was prepared using a cytocentrifuge and stained with DiffQuik.
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Tip

Eggs of *Dioctophyma renale* (giant kidney worm), *Capillaria plica* and *Capillaria feliscati* (bladder worms) may be present in urine.2,9

Examination of modified Wright-stained (or other rapid Romanowsky stained) air-dried smears of urinary sediment at high magnification (high dry or oil immersion, Figure 2) significantly improves the sensitivity, specificity and efficiency of microscopic detection and classification of bacteriuria compared with the wet-unstained method.8

Factors that may affect the detection of bacteria during microscopic examination of urine sediment preparations are outlined in Table 1. For factors that may result in poor correlation between microscopy and urine culture results see Table 2.

**Yeast/fungi**

Fungi, including yeasts, are often contaminants in urine but in an appropriately handled cystocentesis sample should be regarded as significant and submitted for culture. Yeasts may be difficult to distinguish from RBCs or lipid droplets on microscopic examination of wet preparations. Budding forms and a double refractile wall may help identify yeast organisms more easily. Examination of air-dried preparations after cytocentrifugation of urine will also help determine the presence of a yeast/fungal infection.1,2

Fungal culture of appropriately collected urine samples is paramount if identification of a particular yeast/fungus is required.

**Crystals**

Crystals are commonly found in cats on routine urinalysis (Table 3). Further investigation is required to assess the diagnostic and clinical significance of the crystalluria. The starting point should always be microscopic examination of a fresh (<1 h post-collection), non-refrigerated urine sample to avoid possible in vitro artefacts (eg, formation or dissolution of crystals in urine associated with prolonged storage or refrigeration).

**Other urine insoluble particles**

These various insoluble particles are occasionally seen on urine microscopic examination:1,2

**Lipid droplets:**
- usually of no pathological significance and common in feline urine;
- appear as variably sized, green-tinged, round, highly refractile droplets that float beneath the coverslip out of the plane of focus of other sediment elements;
- product of normal exfoliation of aged tubular epithelial cells or seen as a result of exfoliation of tubular cells that have undergone sublethal fatty degeneration;
- also seen with diabetes mellitus and nephrotic syndrome;
- a layer of white lipid is sometimes seen in normal feline urine samples.

**Mucin:**
- mucin strands appear as narrow, twisted ribbons and homogeneous threads (not to be confused with casts).

**Artefacts:**
- include air bubbles, starch granules (from surgical gloves), dust particles, hairs, faeces and bacteria;
- starch granules are sometimes confused with lipid droplets but have scalloped margins, often have a central dimple and are not refractile when viewed by bright light microscopy. Under polarised light, they have a Maltese cross appearance;
- muscle fibres in samples obtained by cystocentesis.
### Table 3: Commonly encountered crystals and their significance in feline urine (continued on page 220)

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Description</th>
<th>Urine pH</th>
<th>Significance</th>
<th>Action/considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnesium ammonium phosphate</strong></td>
<td>Colourless, coffin-like prisms. Often with three to six (or more) sides that typically have oblique ends. Sometimes seen as ‘razorblade’ structures. Occasionally aggregate into fern-like structures</td>
<td>Common in slightly acidic to alkaline urine. Readily dissolved in urine acidified by adding acetic acid</td>
<td>May be found in urine of cats that are apparently healthy, in addition to those with: infection-induced struvite uroliths; sterile struvite uroliths; non-struvite uroliths; urethral plugs that contain struvite crystals; and urinary tract disease without uroliths (eg, feline idiopathic cystitis)</td>
<td>In vitro formation may occur in refrigerated stored samples or samples that become alkaline with storage. Verify true presence of struvite crystals on a freshly obtained urine sample</td>
</tr>
<tr>
<td><strong>Amorphous phosphates</strong></td>
<td>Amorphous granular precipitate. May be a dull brown colour</td>
<td>Found in neutral to alkaline urine (especially alkaline). Readily dissolved in urine acidified by adding acetic acid</td>
<td>May be found in normal urine. May also be associated with in vitro precipitation due to refrigeration</td>
<td>No clinical significance. These crystals may dissolve once urine sample is returned to room temperature before examination</td>
</tr>
<tr>
<td><strong>Ammonium (bi)urate</strong></td>
<td>Yellow–brown, round structures with horn-like projections of variable length (‘thorn apples’). These projections may break off to leave small brown crystals with fine radiating lines</td>
<td>Found in slightly acidic, neutral and, less commonly, alkaline urine. Insoluble in acetic acid</td>
<td>Uncommon in healthy cats. May be associated with hepatic disease (eg, portovascular anomalies) in some cases. Egyptian Mau, Birman and Siamese breeds have been reported to be at increased risk of urate urolith formation but the pathogenesis is unclear10</td>
<td>When present, serum bile acid testing is recommended to exclude hepatic causes</td>
</tr>
<tr>
<td><strong>Amorphous urates</strong></td>
<td>Yellow to yellow–brown amorphous granules</td>
<td>Found in acidic to neutral urine and insoluble in acetic acid</td>
<td>Uncommon in healthy cats. May be associated with in vitro precipitation due to refrigeration</td>
<td>These crystals may dissolve once urine sample is returned to room temperature before examination</td>
</tr>
<tr>
<td><strong>Uric acid</strong></td>
<td>Yellow to yellow–brown pleomorphic diamonds or prisms, oval plates or rosettes</td>
<td>Found in acidic urine</td>
<td>Uncommon in healthy cats Crystals have the same significance as described for ammonium and amorphous urates</td>
<td></td>
</tr>
<tr>
<td><strong>Calcium oxalate dihydrate</strong></td>
<td>Colourless squares, of varying size, displaying an octahedral or envelope shape with corners connected by intersecting diagonal lines</td>
<td>Found most commonly in acidic to neutral urine, although they can form in alkaline urine</td>
<td>Found in urine from normal cats and cats with calcium oxalate uroliths. May also be encountered in cases of ethylene glycol intoxication, particularly if seen in large numbers associated with acute kidney injury and other appropriate clinical signs; less common in this toxicity than calcium oxalate monohydrate crystals</td>
<td>Tendency for in vitro formation. Verify via analysis of a freshly obtained urine sample</td>
</tr>
</tbody>
</table>
### Table 3: Commonly encountered crystals and their significance in feline urine (continued from page 219)

<table>
<thead>
<tr>
<th>Crystal</th>
<th>Description</th>
<th>Urine pH</th>
<th>Significance</th>
<th>Action/considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium oxalate monohydrate (whewellite)</td>
<td>Vary in size and may have a spindle, oval, dumbbell or hemp seed shape. Flat, elongated, six-sided crystals ('picket fence post' or 'stake' appearance)</td>
<td>Found most commonly in acidic to neutral urine, although they can form in alkaline urine</td>
<td>May be found in urine from healthy cats, cats with calcium oxalate uroliths and cats with ethylene glycol toxicity</td>
<td>Tendency for in vitro formation. Verify via analysis of a freshly obtained urine sample. In oliguric acute kidney injury, the presence of these crystals is highly suggestive of ethylene glycol toxicity (though crystals may also be absent in these cases)</td>
</tr>
<tr>
<td>Bilirubin (Figure 7)</td>
<td>Yellow–gold to reddish brown needles or fine spicules arranged freely or in bundles, or occasionally forming granules</td>
<td>Found in acidic urine</td>
<td>Absent in normal cat urine</td>
<td>Presence of these crystals in cats may precede hyperbilirubinaemia. Investigate causes of hyperbilirubinaemia (pre-, intra- or post-hepatic disease) more closely</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Large, colourless, thin, flat rectangular plates with distinct right angles and a characteristic square notched corner</td>
<td>Found in acidic to neutral urine</td>
<td>May be present in normal cat urine</td>
<td>Significance is unknown but cholesterol may be found in the urine of animals with previous urinary tract haemorrhage or degenerative disease</td>
</tr>
<tr>
<td>Cystine</td>
<td>Colourless, flat hexagonal plates that commonly aggregate</td>
<td>Found in acidic urine</td>
<td>Absent in normal cat urine</td>
<td>Cystinuria is a rare inherited metabolic disease characterised by defective amino acid reabsorption</td>
</tr>
<tr>
<td>Sulfonamide</td>
<td>Yellow to yellow–brown crystals in various arrangements: needles, sheaves or spherical with radial striations</td>
<td>Found in acidic urine</td>
<td>Absent in normal cat urine</td>
<td>Associated with sulfonamide administration in dehydrated animals. Identity of these crystals can be confirmed with the lignin test: a drop of urine sediment on newspaper, with one or two drops of dilute hydrochloric acid added, produces a bright yellow–orange colour</td>
</tr>
<tr>
<td>Xanthine</td>
<td>Yellow-brown amorphous granules, spheroids or oval structures that may be impossible to distinguish from amorphous urates or ammonium urates by light microscopy</td>
<td>May precipitate in amorphous form in acidic urine</td>
<td>Absent in normal cat urine</td>
<td>Xanthinuria is a rare inborn error of metabolism in cats</td>
</tr>
<tr>
<td>Melamine/cyanuric acid</td>
<td>Brown to green–brown circular crystals with radiating striations originating from the centre of the crystal</td>
<td>Acidic urine</td>
<td>Absent in normal cat urine</td>
<td>Documented in cats with acute kidney injury with a history of ingesting pet food contaminated with melamine and cyanuric acid</td>
</tr>
</tbody>
</table>

Information based on references 1,2,9–14
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Figure 3: Struvite crystals in (a) an unstained wet preparation (arrows) and (b) an air-dried smear stained with DiffQuik.

Figure 4: Ammonium biurate crystals in cat urine, showing the classic ‘thorny apple’ appearance. (Photograph courtesy of Cornell University)

Figure 5: Amorphous urate crystals in unstained wet preparations; (a) with and (b) without polarisation.

Figure 6: Calcium oxalate dihydrate crystals in a DiffQuik-stained smear viewed at (a) x 40 and (b) oil immersion x 100.

Figure 7: Bilirubin crystals in a DiffQuik-stained smear.
References


This article has been adapted from: George Reppas and Susan F Foster. Practical urinalysis in the cat 2: urine microscopic examination ‘tips and traps’. J Feline Med Surg 2016; 18: 373–385.

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Meeting feline welfare needs: providing guidance for owners

Verniary professionals need to have an understanding of feline welfare needs, as stress can result in clinical disease and problem behaviours. The ‘five pillars’ of a healthy feline environment include provision of a safe place, resource management, positive human interactions, opportunities to play and consideration of smells. Veterinary professionals should proactively explore their patient’s behaviour and welfare to find opportunities to improve their environment and reduce stress.

All animals have needs. These range from physical needs, such as eating and elimination behaviours, to strongly motivated behaviours such as socialisation.

A study comparing the level of knowledge of veterinarians, veterinary nurses and pet owners about cat behaviour concluded that professionals familiar with the needs of cats are in a better position to educate cat owners, thus avoiding undesirable outcomes and ensuring they are equipped to provide the best quality of life for their companions.

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Key point
The implications for not meeting feline welfare needs can be serious: cats may develop problem behaviours that damage the human-animal bond, leading to relinquishment, euthanasia, or invasive procedures such as onychectomy (declawing) in countries where this is permitted.

Needs are species-specific
Different species have different requirements, from shelter to space to social companions and environments that facilitate specific, highly-motivated behaviours.

One framework for assessing animal welfare is the UK Farm Animal Welfare Committee’s Five Freedoms, whereby every animal is entitled to:

1. freedom from hunger and thirst: by ready access to fresh water
by ensuring conditions and treatment that avoid mental suffering.³

All of these impact a cat’s overall welfare. An alternative approach is the ‘five domains’ model. This model encompasses four physical domains (nutritional, environmental, health and behaviour) which contribute to a positive or negative fifth domain — mental or affective state.⁴

In the veterinary clinical setting, staff and owners are often more concerned with freedoms 1 and 3, or nutritional and health domains, with less focus on freedoms 2, 4 and 5, or environmental, behavioural and mental domains. Yet an inappropriate environment, inability to express normal behaviours, and fear and distress or a negative affective state can contribute to poor welfare and problematic behaviour.

Insofar as companion cats are domesticated, we have adapted them to exist alongside humans, in our environments. But, in order to meet their needs, cat owners must — to some extent — adapt themselves and the environment to better suit cats.

The American Association of Feline Practitioners and the International Society of Feline Medicine recently introduced five pillars of a healthy feline environment:

1 **Provide a safe place.**
2 **Provide multiple and separated key environmental resources:** food, water, toileting areas, scratching areas, play areas and resting or sleeping areas.
3 **Provide an opportunity for play and predatory behaviour.**
4 **Provide positive, consistent and predictable human-cat social interaction.**
5 Provide an environment that respects the importance of the cat’s sense of smell.5

**A safe place**
This refers to a cat’s space within the larger household environment. A safe space therefore provides privacy, seclusion and, where possible, the ability to observe (Figures 1 and 2). In multi-cat households, a safe space should have multiple exits so that cats cannot be cornered by other cats.5

Cats are natural climbers and will utilise vertical as well as horizontal space. Cats will often climb to avoid conspecifics or humans, and may use vertical space to cope with stressors.6

Where possible, outdoor access is encouraged as this provides stimulation and an opportunity to mark and explore their territory.

In boarding facilities, cardboard boxes, front-opening cat carriers,
perches and shelves can provide safe places.

What to ask owners:
- Do your cats have outdoor access and, if so, what is the nature of this? (e.g., open access vs restricted, time limited, etc).
- What rooms do your cats have access to in the home?
- Does your cat have access to one or more safe places?

Key environmental resources
At a minimum, key environmental resources for cats include food, fresh water, a litter tray, a bed or resting place, and a safe point of exit. Cats should be able to access these resources without necessarily having to pass another (household or neighbourhood) cat. Where possible, these key resources should be separated — a cat should not be toileting adjacent to the spot where he or she eats.5

Where space permits, cats should be offered choice,5 for example between two toileting areas, to exercise some control over their environment (Figure 3).

What to ask owners:
- Where in (and outside) the home are the above key resources located? (It can be helpful for the owner to draw these on a floor/house plan.)
- Are key resources placed in the site of other cats from within or outside of the home?

Play and predatory behaviour
Cats are natural hunters, catching and eating up to 10–20 small prey per day.5 It is therefore not surprising that the majority of play behaviours in cats and kittens are focused around objects or prey-targets.6 Play sessions and toys should be designed to allow cats to express this predatory behaviour. For example, Dantas and colleagues have provided an excellent article on the creation of food puzzles to encourage cats to ‘work’ for their food as they would in the wild.7 Feeding cats in this way also increases physical activity, a key component in reducing obesity, in cats that might lead otherwise sedentary lives (see Food puzzles for cats: feeding for physical and emotional wellbeing. Feline Focus 2016; 2[10]: 289–296).
The use of rod or wand toys with feathers attached can mimic both flying and ground prey, while the use of stuffed toys allow cats to rake and bite.⁵

What to ask owners:
- How often do you play with your kitten/cat?
- What does this involve?
- How is food (including treats) presented to your cat?

Social interaction
Cats in the wild are solitary creatures. They have been domesticated as companions for humans, but interactions with humans can cause distress if these are forced, irregular, negative or unpredictable. For example, it is not uncommon for cats to dislike being picked up, yet some owners persist against the cat’s will — reinforcing this negative state. Learning to understand feline body language empowers owners to reduce negative encounters.

Owners, veterinarians and nurses should aim to provide ‘consistent, predictable, friendly human contact’ wherever possible.⁵ Some cats are naturally more affectionate or human-seeking than others. Education about feline body language may be helpful here.

Introductions of new kittens or cats into the household should be undertaken slowly, as this can be a major source of stress for cats.

What to ask owners:
- How do you interact with your cat?
- What interactions do you think your cat enjoys and why?
- What interactions do you think your cat is not so keen on? Why?
- (Where a new kitten or cat will be introduced) how are you planning to introduce these cats?

The olfactory environment
Cats have a more sensitive sense of smell than humans, and use scent to evaluate and mark their

Figure 4: (a and b) Plants provide olfactory stimulation for indoor cats. It is worth warning owners that it is normal behaviour for cats to chew and ‘trash’ these plants. Catnip, grass, sage, thyme, parsley and wheat are good plants to suggest.
surroundings.\textsuperscript{5} Feline temporal, cheek, perioral, interdigital, caudal and tail scent glands are used to release pheromones used to communicate with other cats.\textsuperscript{5} The introduction of very strong smells (for example, ammonia in household cleaning products) or novel scents (for example, on another household cat that has been to the veterinarian or a neighbour’s cat spraying around the house) can be stressful to cats.

The use of synthetic feline facial pheromones (for example, Feliway) can be used to increase feline comfort. Spot-cleaning, rather than complete bedding changes, can help maintain familiar scents in the cat’s environment.\textsuperscript{5}

Cat-nip containing toys, and plants such as cat nip and cat grass can be used to provide olfactory enrichment (Figures 4 and 5).

Scratching is a normal feline behaviour used for both chemical and visual marking, yet inappropriate scratching is a common complaint from owners.\textsuperscript{8} Provision of scratching areas both indoors and outdoors (Figure 6) is recommended.\textsuperscript{5} These can be trees, wood, carpeted posts, corrugated cardboard or rope.\textsuperscript{8}

**What to ask owners:**
- How do you clean your cat’s bedding/litter/resting areas?
- What items and areas are available for your cat to mark by scratching?
- Have you tried scents or pheromones in your cat’s environment? If so, which ones?

**Checking in**
Veterinarians and nurses should proactively explore feline behaviour and welfare in the consultation. One study found that dental and
behavioural non-presenting or ‘by the way’ problems were more frequently discussed during preventive-medicine consultations compared with specific health-problem related consultations. Vaccination, preventive or wellness consultations may be the ideal forum for owners to discuss the welfare needs of their cats, and develop strategies to ensure these needs are being met.

References